Medium Voltage Distribution

PIX

Motor Control Center up to 7,2 kV

Installation
Operation Maintenance
Technical Manual

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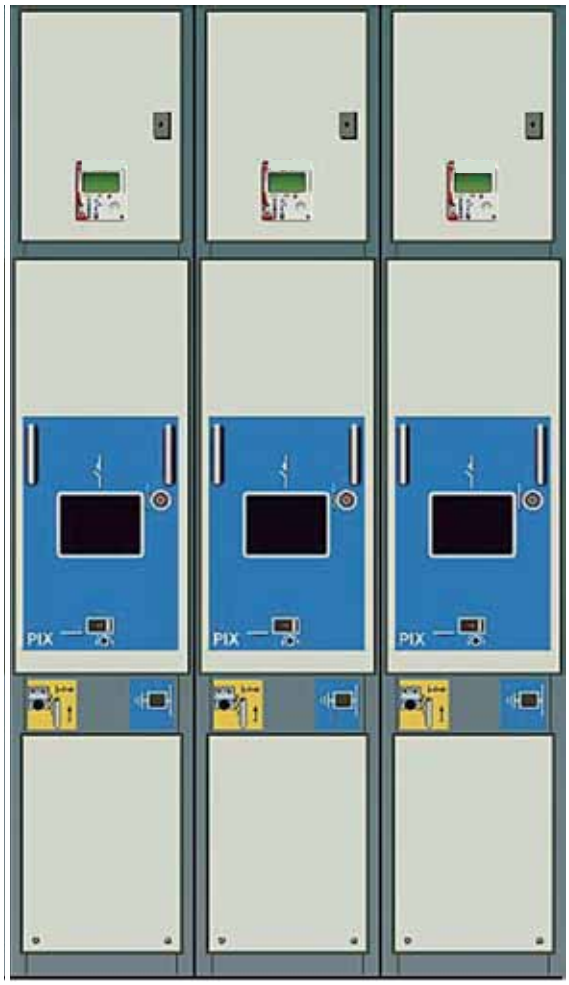

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The Technical Manuals which are exclusively valid are always supplied by the manufacturer together with the product in question.

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Remarks on this manual

As our products are subject to continuous further development, we reserve the right to make changes regarding standards, illustrations and technical data.
All dimensions specified in this manual are in millimeters.

Purpose and target group

This Technical Manual describes assembly, operation and maintenance of medium-voltage switchgear of the PIX Motor Control Center series.

The work described in this manual may only be performed by specialist electricians with proven experience regarding
- the PIX series (training certificate)
- all relevant safety provisions.

This Technical Manual is an integral part of the product and must be stored such that it is at all times readily accessible for and can be used by persons who are to work on the switchgear. If the switchgear is sold to new owners, they must receive this document along with the switchgear.

This Technical Manual does not include information regarding the safety of buildings in case of internal faults (pressure load of the switchgear room and necessary pressure relief ports). Pressure calculations for switchgear rooms incl. recommendations regarding pressure relief ports can be provided on request against a fee. For further details, please contact the manufacturer.

This Technical Manual cannot describe every imaginable individual case or every customer-specific version of the product.

For information which is not included in this manual, please contact the manufacturer.

Reference documents

The following additional documents must be complied with:
- Purchase agreement containing the stipulations on the specific equipment of the switchgear and the legal details
- the switchgear-specific circuit diagrams / documentation
- the operating manuals of the low-voltage devices installed in the switchgear (e.g. voltage presence indicating systems, devices in low-voltagecompartment, GEMSTART monitoring and motor protection device)
- the assembly drawings supplied with the switchgear
- the Assembly and Operating Manuals of the switching device Vacuum Contactor CVX (no. NTV 132 2E)
- the Assembly Instructions of the manufacturer of the cable connection systems to be connected to the switchgear
- the switchgear configuration PIX
- the Technical Manual for PIX switchgear panels with circuit-breaker
- the Technical Manual for PIX additional equipment (No. AMTNoT 077-02)
- the assembly, operating and maintenance instructions of PIX High (No. AGS 531502-02

Terms and symbols used

This manual uses certain terms and symbols. They warn about dangers or provide important information which must be complied with in order to avoid danger to persons and damage to equipment:

Remarks on this manual (contd.)

Danger!"
This danger symbol warns about dangerous electrical voltage. Contact with voltage may result in fatal injury!

"Warning!"
This danger symbol warns about the risk of injury. Please comply with all the provisions identified by this symbol in order to avoid death or serious injury.

"Warning!"
This danger symbol warns about the risk of falling.

"Important:"
This instruction symbol is used for information which is important to avoid material damage.

Abbreviations used

"PIX High MCC": PIX Motor Control Center for PIX High series
"CVX": Vacuum contactor with high voltage fuse link on a truck

Any questions or suggestions?

Do you have any questions or suggestions regarding this manual, or do you require further information?

We always strive to provide you with the best-possible information for optimum, safe use of our products. Thus, do not hesitate to contact us if you have any recommendations, amendments or proposals for improvement.

1 Safety provisions

The work described in this manual may only be performed by specialist electricians who have proved their experience with the PIX Motor Control Center and the applicable safety provisions.

Please read the whole manual carefully before working on the panel.

Applicable standards and regulations

- Metal-enclosed AC switchgear for rated voltages > 1 kV up to including 52 kV: IEC 62271-200
- the locally applicable accident prevention, operating and work instructions
- Assembly and maintenance: IEC 61936-1/HD 637 S1[1]
- Operation of electrical equipment: EN 50110-1[1]

[1] The national standards applicable in the country where the equipment is to be installed must be complied with.

Before performing work on the panel, it is essential that you comply with the following instructions:

Danger!
Risk of fatalities due to high voltage. Isolation from high voltage and earthing must always be ensured before performing assembly or maintenance work.

Danger!
Risk of fatalities due to high supply voltage. Isolation from supply voltage before must always be ensured before performing assembly or maintenance work.

Warning!
Risk of injury due to movable parts in mechanical drives. For maintenance work,
- **isolate from supply voltage**
- **switch ON via the make-proof earthing switch.**

Warning!
After the removal of covers from a switchgear, operator safety regarding internal arcs may be reduced unless the switchgear is isolated from the power supply. Optimum operator safety is only ensured if the switchgear is completely disconnected from the power supply and grounded during assembly.

Behaviour in case of incidents or accidents

The panels of the PIX Motor Control Center series feature pressure relief ports for the case of an internal fault; these ensure operator safety according to IEC 62271-200.

In case of fire or of internal faults, toxic and caustic decomposition products may be produced. Comply with the locally applicable accident and safety provisions.

In case of personal injury, take first-aid measures or cause them to be taken.

2 Panel description

2.1 Panel design

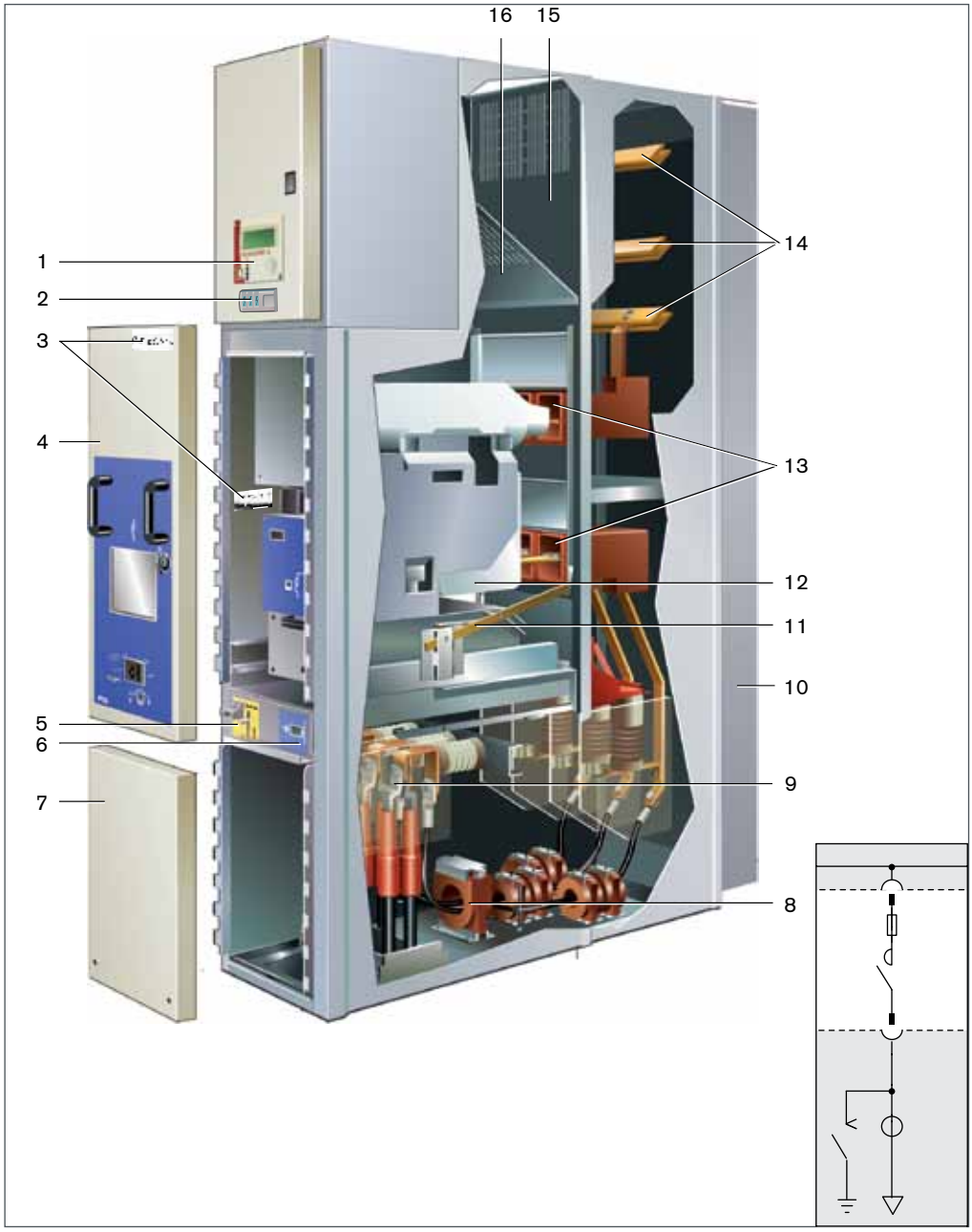


Fig. 1
PIX Motor Control Center

1 Low-voltage cabinet with GEMSTART 5 control unit
2 Voltage indicator (option)
3 Nameplate
4 Cover of switching device compartment
5 Operation of the earthing switch
6 Earthing switch position indicator
7 Cable compartment cover
8 Current transformer
9 Cable connection
10 Pressure relief duct for cable compartment
11 Shutter actuation
12 Truck-type vacuum contactor CVX with fuses
13 Bushings
14 Busbars
15 Pressure relief flap for busbar compartment
16 Pressure relief flap for switch compartment

2 Panel description (contd.)

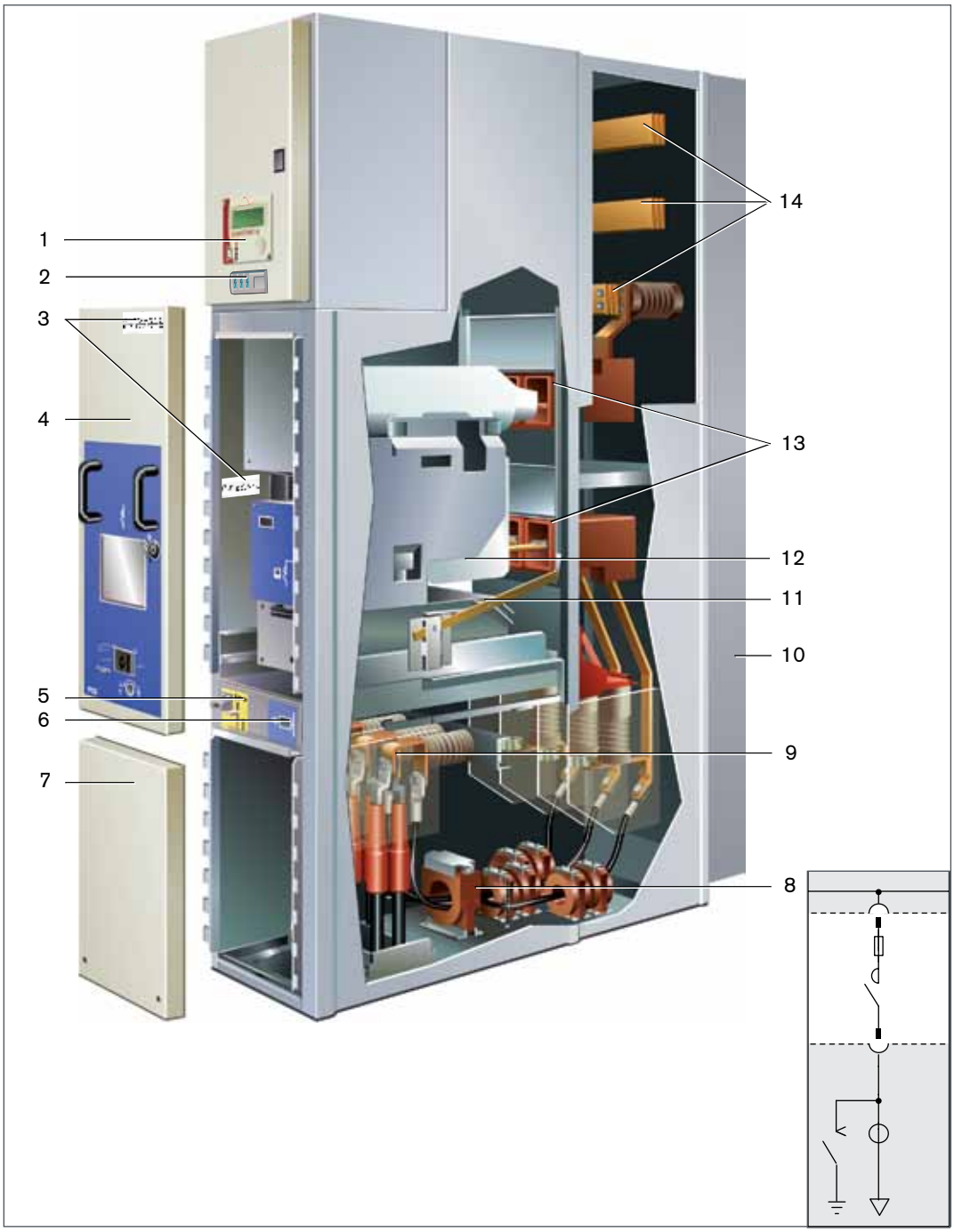


Fig. 2
PIX Motor Control Center for PIX High series

1 Low-voltage cabinet with GEMSTART 5 control unit
2 Voltage indicator (option)
3 Nameplate
4 Cover of switching device compartment
5 Operation of the earthing switch
6 Earthing switch position indicator
7 Cable compartment cover
8 Current transformer
9 Cable connection
10 Pressure relief duct for cable compartment
11 Shutter actuation
12 Truck-type vacuum contactor CVX with fuses
13 Bushings
14 Busbars

2 Panel description (contd.)

2.2 Applied standards

Type PIX Motor Control Center panels are
- metal-enclosed; loss of service continuity category acc. to IEC 62271-200: LSC 2B-PM
- air-insulated
- type-tested
- tested for internal faults (IAC AFLR)
- dimensioned for indoor installation

Panels of the PIX Motor Control Center series meet the following standards and regulations:

Designation	IEC standard	EN standard
Switchgear	IEC 62271-200 IEC 62271-1	EN 62271-200 EN 62271-1
Internal arc classification (IAC)	IEC 62271-200	IEC 62271-200
Vacuum contactor	IEC 60470	IEC 60470
High-voltage fuse link	IEC 60282-1 IEC 60644	IEC 60282-1 IEC 60644
Earthing switch	IEC 62271-102	IEC 62271-102
Isolating function	IEC 62271-102	IEC 62271-102
Current transformer	IEC 60044-1	EN 60044-1
Voltage detection systems	IEC 61958 IEC 61243-5 (optional)	IEC 61958 IEC 61243-5
Protection against accidental contact, foreign bodies and water	IEC 60529	EN 60529

Degrees of protection against accidental contact and foreign objects according to IEC 62271-200 and IEC 60529	
Degree of protection of switchgear enclosure	IP3X[1]
Degree of protection of the accessible claddings in the panel	IP2X

[1] other values available on request

2.3 Environmental and operating conditions

PIX is an indoor switchgear and may only be operated under normal conditions in acc. with IEC 62271-1.

The ambient air must be free of dust, smoke or vapours.

Operation under conditions deviating from these is only admissible subject to consultation with and written approval from the manufacturer.

Ambient conditions in accordance with IEC 62271-1 and IEC 60694		
Temperature class		“Minus 5 indoors”[1]
Min./max. ambient temperature	°C	–5/+40[1]
Average value over 24 hours	°C	≤ 35[1]
mean rel. air humidity: 24 hour/1 month	%	≤ 95/≤ 90
Installation altitude above sea-level	m	≤ 1000[1]

[1] higher values available on request

2.4 Technical data

Technical data		
Rated voltage U_r	**[kV]**	3.6/7.2
Rated lightning impulse withstand voltage U_p	**[kV]**	40/60
Rated power frequency withstand voltage U_d	**[kV]**	20 (32)[1]
Rated normal current, busbar I_r	**[A]**	≤ 4000
Rated normal current, outgoing feeder panel I_r	**[A]**	≤ 400
Rated short-time current I_k of busbar	**[kA]**	≤ 40 (3 s) ≤ 50 (3 s)[2]
Rated frequency f_r	**[Hz]**	50 / 60

[1] on request (optional)
[2] Declaration true for PIX Motor Control Center for PIX High series
For the technical data of the vacuum contactor CVX, please refer to its separate Operating Instructions (no. NTV 132 2E).

2.5 Nameplate

The nameplate on the panel (Fig. 1 on page 8, item 3 and Fig. 2 on page 9, item 3) specifies essential technical data. They are mounted on the cover of switching device compartment and in the switching device compartment.

The following data on the nameplate are relevant in case of any queries:
- Type designation
- Serial number
- Year of construction

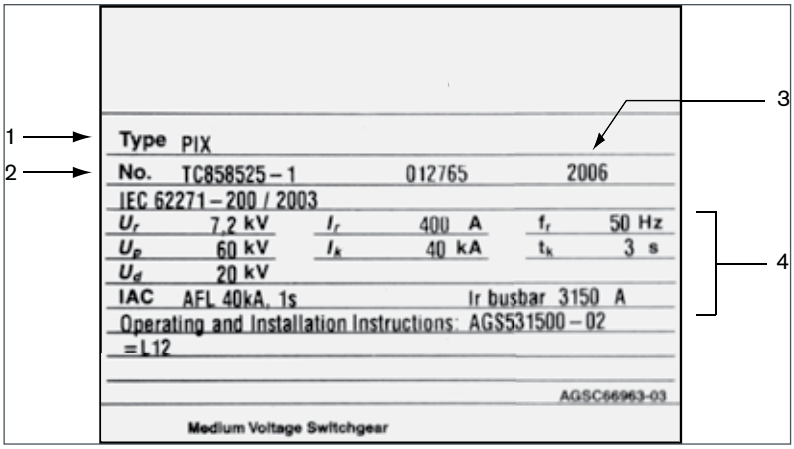
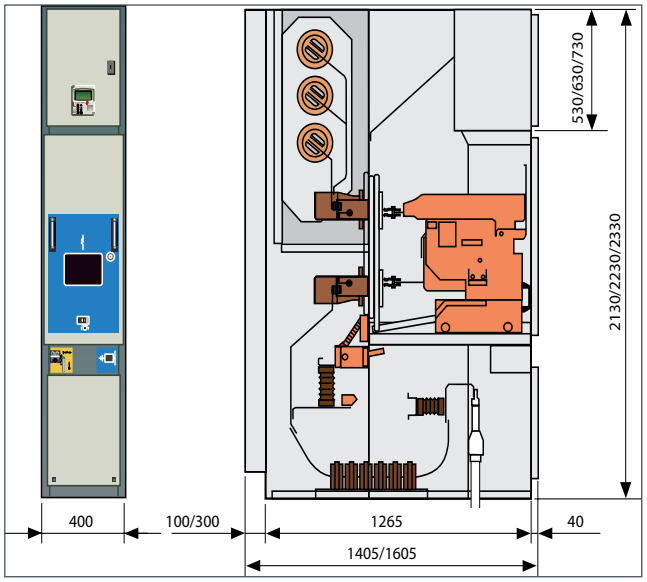


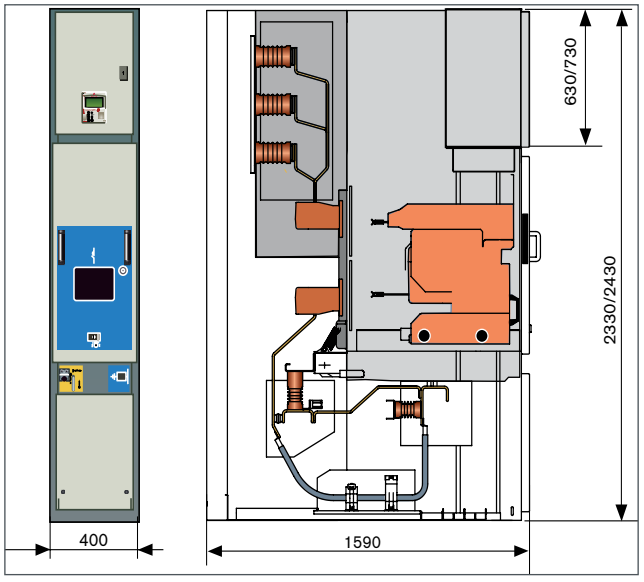
Fig. 3
Nameplate of the PIX Motor Control Center PIX High series on the cover of switching device compartment
1 Type designation
2 Serial number
3 Year of construction
4 Technical data

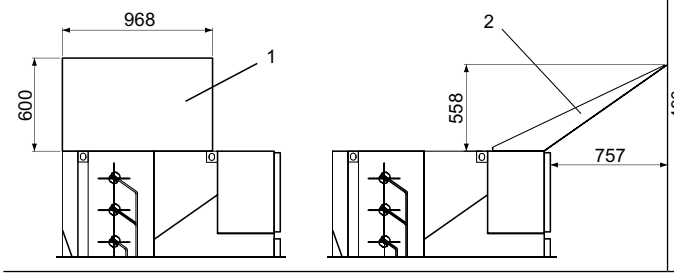
2.6 Dimensions and weights

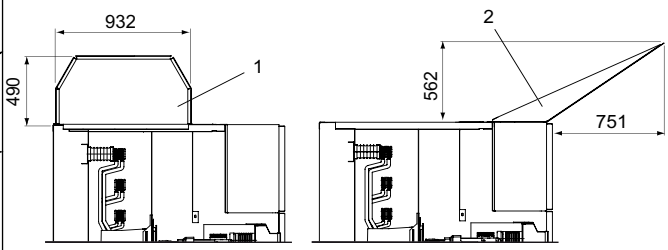
Dimensions of PIX switchgear panel

PIX Motor Control Center	PIX Motor Control Center PIX High series









1 Pressure relief duct
2 Deflector

Weights

Max. weight ■ with CVX truck, ■ without packaging, ■ incl. low-voltage compartment an with average extent of equipment mounted ■ incl. shutters or pressure relief duct. ■ The busbars have been taken into consideration with a maximum weight at 4000 A.	≤ 700 kg

2 Panel description (contd.)

2.7 Intended use

PIX Motor Control Center medium-voltage switchgear units are exclusively intended for switching and distributing electrical energies. They may only be used in the scope of the specified standards and the switchgear-specific technical data. Any other utilization constitutes improper use and may result in dangers and damage.

Liability Disclaimers

The manufacturer shall not be held responsible for damage which occurs if
- instructions in this manual are not complied with;
- the switchgear is not operated according to its intended use (see above);
- the switchgear is assembled, connected or operated improperly;
- accessories or spare parts are used which have not been approved by the manufacturer;
- the switchgear is converted without the manufacturer's approval, or if inadmissible parts are added.

No liability is accepted for parts provided by customers, e. g. current transformers.

2.8 Disposal after the end of service life

Upon request, a material and recycling data sheet is available for disposal of switchgear of the PIX Motor Control Center series at the end of its service life.

Disposal is performed as a service by the manufacturer's Service Center and is subject to a fee.

3 Packaging, transport, storage

3.1 Shipping units

- The conditions and types of transport have been stipulated in the contract details.
- The type of packaging depends on the type of transport and the storage conditions.
- The panels are delivered individually and are fastened on transport aids. The standard accessories are included.
- The vacuum contactor CVX truck is supplied in assembled condition, already mounted in the panel.
- The panels are delivered in upright position.

Important:
The weight of the entire transport unit is indicated on the packaging/ wooden crate.

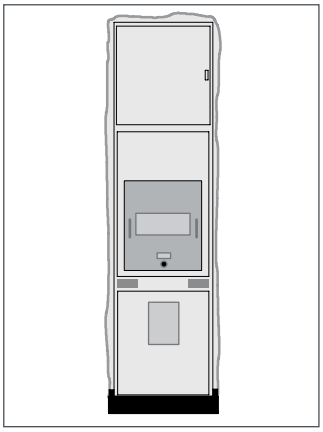


Fig. 4
Packed in PE protective film on a pallet

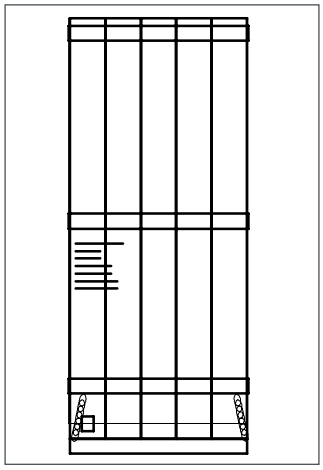


Fig. 5
Packed in a wooden case

Packaging

- If packed exclusively for truck transport, the panels are delivered on a pallet with PE protective film (Fig. 4).
- For sea transport, the panels are packed in sealed aluminium film with desiccant and in a closed wooden crate with tightly closed wooden base (also for container transport, (Fig. 5).
- In case of air transport, the panels are packaged in wooden crates with a protective PE film hood (dust protection) or in wooden crates, also with closed wooden bases, however without protective hoods (dust protection, Fig. 5).

3.2 Transport

Warning!
Risk of injury if load is not sufficiently secured! Make sure that the transported units do not slip or tilt during transport of the panels.

Important:
For transporting the trucks, comply with the transport specifications in the appropriate manuals.

3 Packaging, transport, storage (contd.)

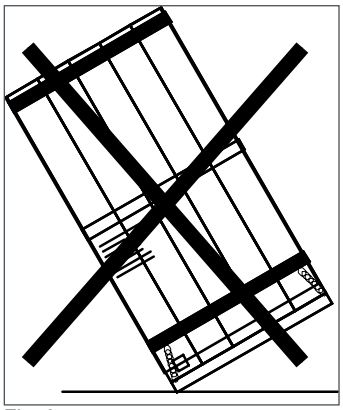


Fig. 6
Do not tip the transport unit

Fig. 7
Transport using a forklift truck

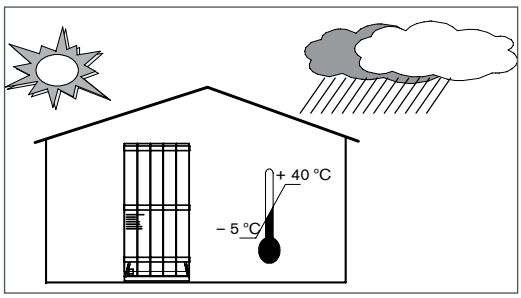


Fig. 8
Schematic diagram of storage conditions for PIX Motor Control Center

Transport using a forklift truck

For transport, the panels must be packaged completely. The entire length of the forks must be placed under the transport unit (Fig. 7).

3.3 Storage

Warning!
Sufficient stability and evenness of the supporting area (floor) must be ensured.

If the panels are not installed immediately after delivery, they can be stored under the following conditions:

- Panels must be stored in vertical position, and must not be stacked.
- Storage only admissible indoors
- Panels and accessories must be packed in a wooden crate with a dessicant and sealed in aluminium foil (storage period max. 2 years after date of packaging).

4 Access to the main circuit compartments

4.1 Safety provisions and important information

Warning!
Risk of injury due to non-respect of the safety provisions in Chapter 1, page 7.

Important:
The panels can be equipped optionally with additional interlocks for the cable compartment cover and the switching device compartment cover. In this context, also refer to Chapter 10.4 ”Interlocks” as of page 51.

4.2 Access to the cable compartment

Danger!
The cable compartment may only be opened if the earthing switch is ON (see Chapter 10.9.1, page 57).

4.2.1 Removing the cable compartment cover

- Release the securing bolts of the cable compartment cover (Fig. 9, item 1).
- Lift and remove the cable compartment cover (2).

Fig. 9
1 Release securing bolts of cable compartment cover
2 Lift cable compartment cover and remove it in forward direction

Mounting the cable compartment cover

After terminating assembly work, position cable compartment cover right on the panel, lower it and fasten it again using the securing bolts.

4.2.2 Removing the truck carrier

The truck carrier can be removed if required, for example for maintenance work (Chapter 11, as of page 59) or to improve access to the cable compartment.

- Remove the truck from the panel (see Chapter 4.5, page 19).
- Remove the auxiliary switch block for the truck (Fig. 10, item 1) and deposit it carefully in the cable compartment.
- Remove the securing bolts of the truck carrier (2).
- First raise truck carrier on the front, then pull it out (3).

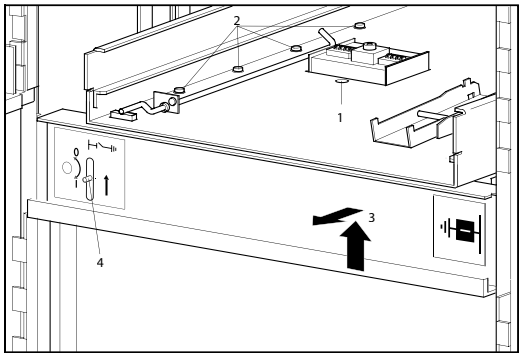


Fig. 10
Removing the truck carrier
1 Fastening the auxiliary switch block
2 Securing bolts of the truck carrier
3 Raise truck carrier on the front and pull it ut
4 Slide for earthing switch actuation

4 Access to the main circuit compartments (contd.)

Re-install truck carrier

Re-install truck carrier and removed components by reversing the above order. When screwing the truck carrier down, make sure that the slide (Fig. 10, item 4) to open the insertion opening for the earthing switch operates smoothly. If necessary, release bolts and reposition the truck carrier.

4.3 Access to the switching device compartment

Danger!
The switching device compartment may only be opened if the truck is in disconnected position (see Chapter 10.8 on page 56).

4.3.1 Opening and closing the cover of the switching device compartment

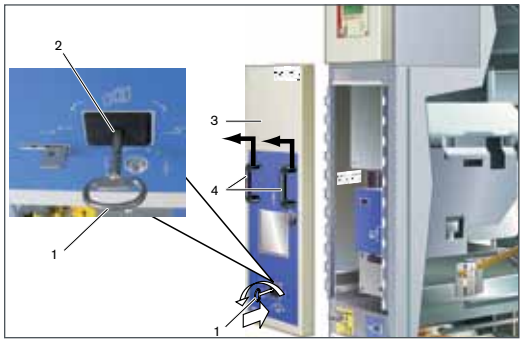


Fig. 11

1 Double-bit key
2 Door lock
3 Switching device compartment cover
4 Handles

Opening the cover

- To unlock the door, insert the appropriate double-bit key (Fig. 11, item 1) in the door lock (2) and turn it counter-clockwise to its stop. The cover is unlocked.
- Lift the cover of the switching device compartment (3) using the two handles (4) and remove it.
- Remove the double-bit key and keep it in a safe place.

Closing the cover

- Pick up the switching device compartment cover (Fig. 11, item 3) using the two handles (4), place it in the cutout on the panel and lower it.
- Insert the double-bit key (1) used to unlock the door into the lock (2) on the switching device compartment cover and turn it clockwise to its stop. The cover is locked.
- Remove the double-bit key and keep it in a safe place.

Removing the transport securing device of the truck

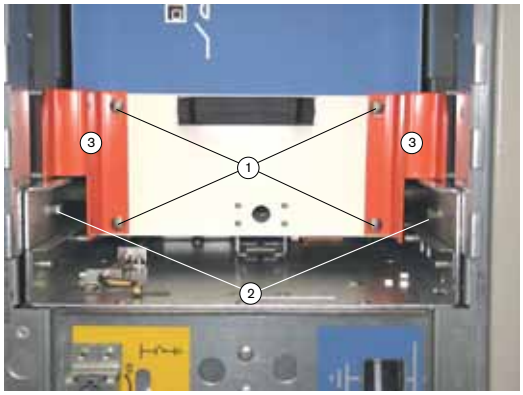


Fig. 12
Transport catch of the vacuum contactor CVX in the panel

- Remove the cable compartment cover (see Chapter 4.2 on page 17) and the switching device compartment cover (see Chapter 4.3 on page 18).
- Remove the locking mechanism of the vacuum contactor CVX in the switch compartment (Fig. 12):
  - Release the 4 front screws of the CVX (1).
  - Release the 2 lateral securing bolts M8x25 (2).
  - Remove both fixing brackets (3).
  - Re-fasten the 4 screws (1) to the CVX.
- Remove the vacuum contactor CVX from the panel (see Chapter 4.5, page 21).

4 Access to the main circuit compartments (contd.)

4.4 Connection and removal of the low-voltage connector

Initial situation:
- Vacuum contactor OFF
- Truck in disconnected position
- Switching device compartment cover removed (see Chapter 4.3 on page 18).

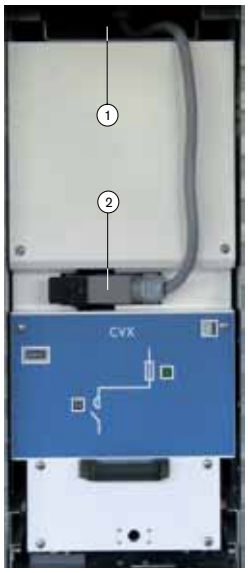


Fig. 13
Vacuum contactor CVX with locked lowvoltage connector
1 Storage tray for low-votage connector
2 Low-voltage connector

Removing the low-voltage connector

- Unlock the interlock of the low-voltage connector (3) and remove the connector.
- Store the low-voltage connector in the storage tray above the vacuum contactor CVX (Fig. 13, item 1).

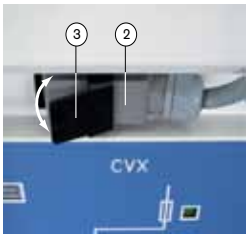


Fig. 14
2 Low-voltage connector
3 Connector interlock with actuating directions

Connecting the low-voltage connector

- Take the low-voltage connector out of the storage tray above the vacuum contactor CVX (Fig. 13, item 1).
- Insert the low-voltage connector into the vacuum contactor CVX (Fig. 14, item 2) and lock the connector interlock (3).

4.5 Removing the truck from the panel

Danger!
Fixed contacts behind the shutters may be under high voltage. Use a U lock to lock the shutter mechanism (see Chapter 10.4.3, page 53), or earth busbar and cable connection.

Important:
Observe the description of the trolley (see Chapter 12.5, page 65). See the Technical Manual PIX Panels with circuit-breaker for a detailed description of the rack-in/rack-out procedure.

Initial situation:
- Vacuum contactor OFF
- Truck in disconnected position
- Switching device compartment cover removed (see Chapter 4.3 as of page 18).
- Low-voltage connector removed (see Chapter 4.4, page 19).

4 Access to the main circuit compartments (contd.)

Removing the truck from the panel

- Adjust the trolley to the CVX track width (see Chapter 12.5, page 65).
- Move the transport trolley in front of the panel and lock it onto the panel.
- Unlock the CVX vacuum contactor in the panel and, using the handle, pull it onto the trolley until it is automatically locked there. Check interlock.

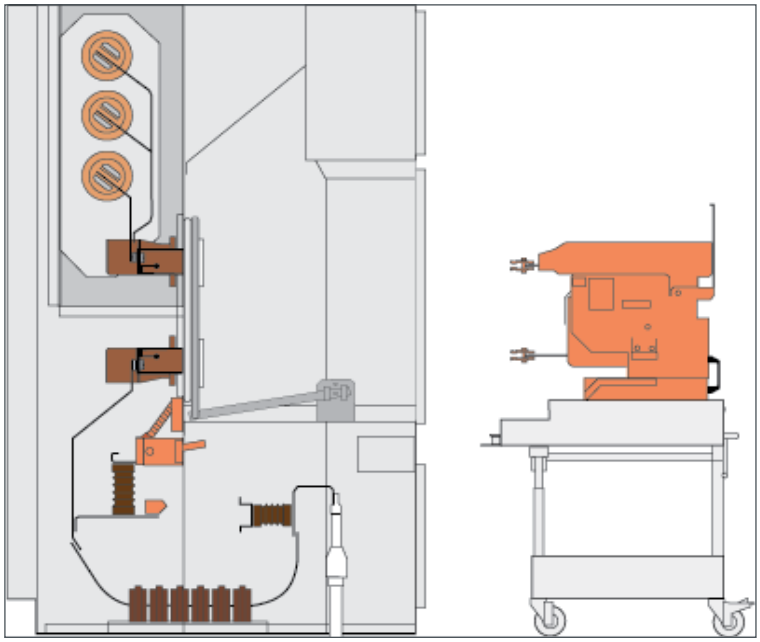


Fig. 15
Vacuum contactor CVX on the transport trolley

Inserting the truck into the panel

- Move the transport trolley right in front of the panel and lock it to the panel.
- Unlock the CVX vacuum contactor on the trolley and rack it into the panel until it is automatically locked in the panel. Check interlock.

4.6 Access to the busbar compartment

Danger!
Risk of fatalities due to high voltage. The busbar compartment may only be opened if the busbar is earthed (see Technical Manual PIX Panels with circuit-breaker).

The busbar compartment is accessible from the top and, in case of first assembly, also from the side.

For top access, the busbar compartment cover must be removed first (Fig. 16).

Warning!
The top sides of the panels are not meant to be walked on. Persons may fall through them, get injured or may damage the panel. When work has to be performed on the panel top - e.g. assembly of deflectors, fans or pressure relief ducts - temporarily position a solid base plate to step on.

4 Access to the main circuit compartments (contd.)

- In order to walk on the top of the panels, fix a solid base plate to step on above the pressure relief duct (3).
- Release the 6 securing bolts from the cover (2). Keep the securing bolts and the cover for the subsequent reassembly.
- Remove the cover (1).

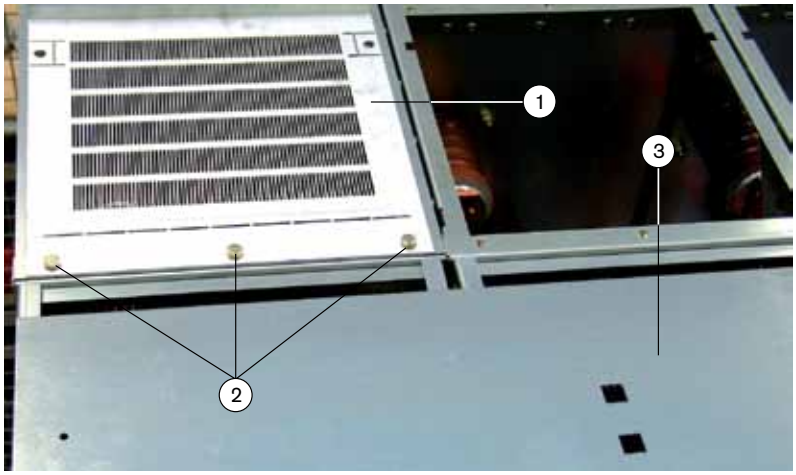


Fig. 16
Top access to the busbar compartment
1 Busbar compartment cover
2 Securing bolts (6x)
3 Solid base plate to step on

5 Assembly of the PIX Motor Control Center Panels

5.1 Safety provisions

The switchgear panels may only be installed and assembled by the manufacturer's staff or by persons who have been certified for this work.

PIX Motor Control Center are delivered with the earthing switch ON.

Warning!
Risk of injury due to movable parts in mechanical drives. The energy-storing device of the earthing switch must not be tensioned during assembly.

Warning!
Risk of accidents! Watch out for floor openings in the switchgear room.

Warning!
The top sides of the panels are not meant to be walked on. Persons may fall through them, get injured or may damage the panel. When work has to be performed on the panel top - e.g. assembly of deflectors, fans or pressure relief ducts - temporarily position a solid base plate to step on.

Warning!
Risk of injury due to non-respect of the safety provisions in Chapter 1 on page 8.

5.2 Important instructions for assembly

Important:
- Condensation, dirt and dust during assembly should be avoided on all accounts, in order to prevent damage to the panels.
- For assembly, observe the assembly drawings supplied with the equipment. Read them before you commence assembly work.
- For all screw connections, refer to the tightening torques specified in Chapter 12.3 on page 64.
- Assembly of the switchgear-specific equipment (e.g. sidewalls, deflectors, pressure relief ducts, etc.) is described in the manual for PIX additional equipment AMT NoT077-02.

5.3 Requirements regarding the switchgear room

Before installing the switchgear panels, make sure that the switchgear room is checked according to the switchgear documentation (Fig. 17).

- Observe the minimum distance between the switchgear and the wall of the building.
- The load-bearing capacity of the fastening areas must correspond to the weight of the switchgear (perform a stress analysis of the building).
- Check base frame (if used) for dimensions and positional tolerances.
- Check position of floor openings for high-voltage and low-voltage cables.

Before the swichgear is positioned at its site of installation, check that the fastening points are level. Unevenness must not exceed ± 2 mm/meter and 6 mm difference in height over the entire switchgear width.

5 Assembly of the PIX Motor Control Center Panels (contd.)

Important:
Observe switchgear-specific space assignment plan.

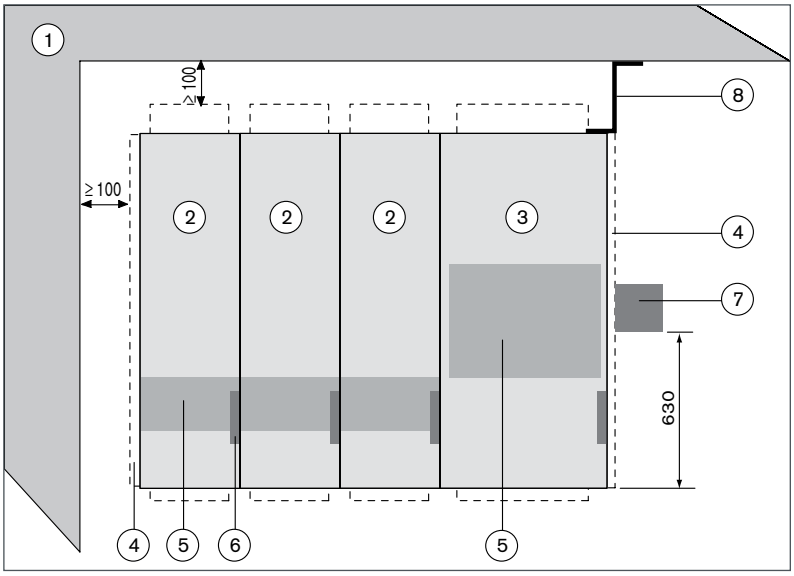


Fig. 17
Switchgear room (top view)
1 Wall of the switchgear room
2 PIX Motor Control Center panels
3 PIX panel 12 kV
4 Switchgear side walls
5 Bushings for high-voltage cables
6 Bushings for low-voltage cables
7 Bushing for the connection of the switchgear earth with the earthing duct
8 Gap cover

5 Assembly of the PIX Motor Control Center Panels (contd.)

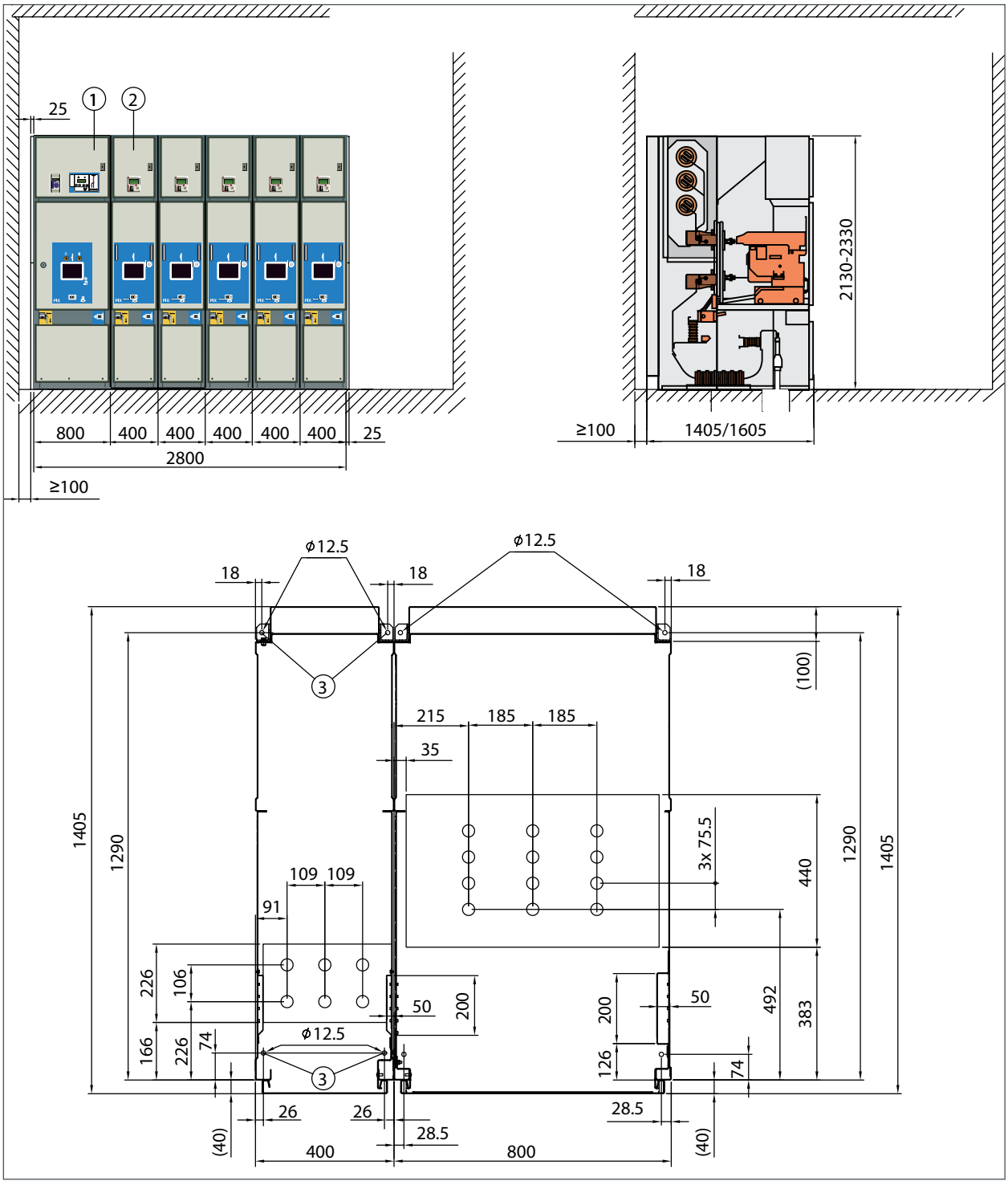


Fig. 18
Dimension drawing for PIX Motor Control Center
1 PIX 12 kV
2 PIX Motor Control Center
3 Bore-holes for fastening of pane

5 Assembly of the PIX Motor Control Center Panels (contd.)

5.4 Transporting the panels on the construction site

Warning!
Make sure the rope or chain is strong enough to bear the weight of the panel. Comply with the relevant provisions for hoisting equipment.

Warning!
On lowering the panels, make sure that the supporting platform is sufficiently stable and even.

Warning!
Risk of accidents. Pay attention to floor openings!

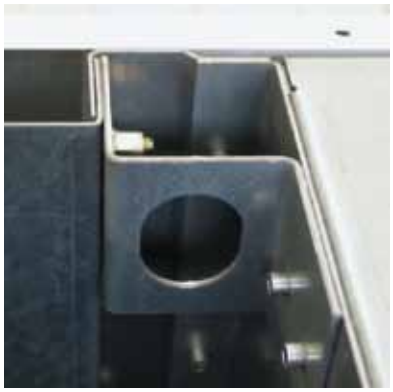


Fig. 19
Jack rings for crane transport on the panel top

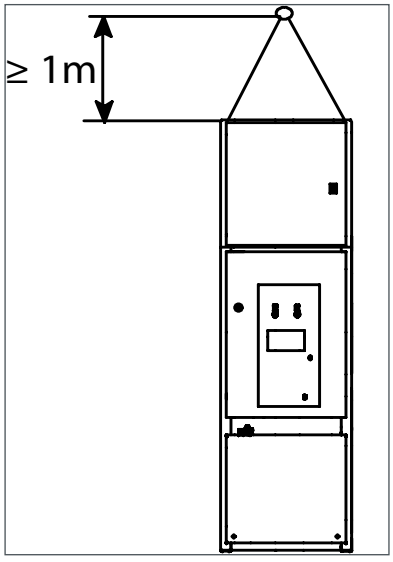


Fig. 20
Observe the minimum height

Transport of panel by means of a crane

- Attach the crane straps in the four jack rings on top of the panel (Fig. 19). Make sure to leave a minimum height of 1 m (Fig. 20).
- Release the front and rear panel screw fastening from the transport packaging. To this effect, remove the cable compartment cover (see Chapter 4.2, page 17).
- Carefully lift the panel and deposit it at the intended location.

5 Assembly of the PIX Motor Control Center Panels (contd.)

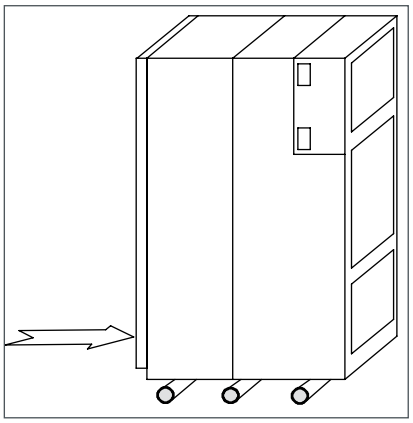


Fig. 21
Transport on rollers

Transport of the panel on the floor

- Push panel onto three cylindrical rollers (minimum diameter 30 mm) (Fig. 21).
- Thus, move the panel until it reaches its final location.

5.5 Aligning and fastening panels

Important:
The position of the first panel is decisive for placement of the subsequent panels, thus it is essential that measuring is effected with the utmost precision!

Fastening on concrete foundations

- Position first panel on the foundations in accordance with the switchgearspecific space assignment plan.
- Remove cable compartment cover (see Chapter 4.2, page 17).
- Align panel. Check the panel front for correct horizontal and vertical position. If applicable, lift the panel and place shims in the direct vicinity of the fastening areas, until the horizontal position has been reached. Assembly drawing: SEM 102 173-01
- Screw-fasten the panel to the two fastening points provided on the front and to at least one fastening point on the rear (see also Fig. 22); hex. bolt M10 x 30 + dowel pin.

Important:
Panel fastening with seismic qualification or vibration-proof characteristics can be supplied on request. For further details, please contact the manufacturer.

5 Assembly of the PIX Motor Control Center Panels (contd.)

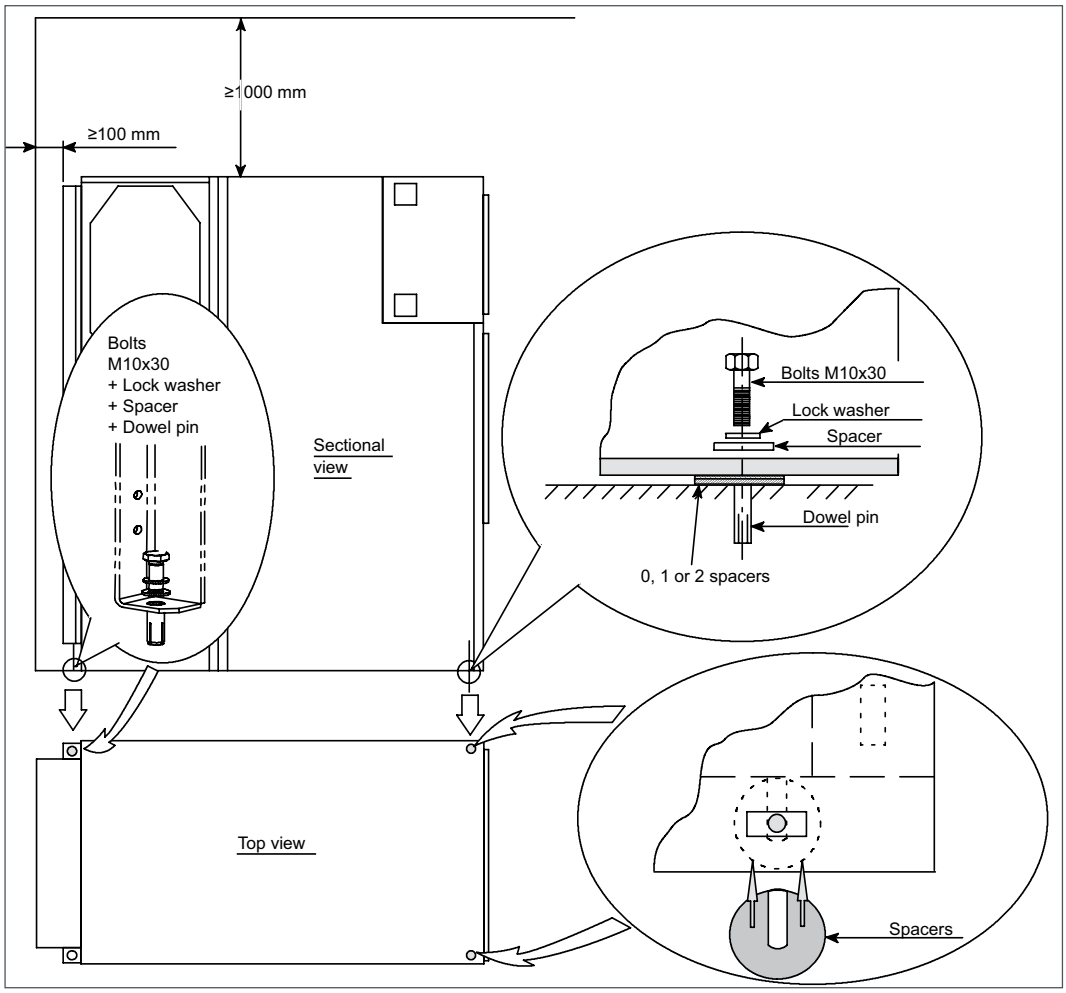


Fig. 22
Fastening of panels on concrete foundations

5.6 Screw-fastening the panels to one another

Assembly drawing: SEM 102056-01

- Screw-fasten panel fronts to one another using 6 fastening points (Fig. 23).
- Fasten panels to one another at the top on the rear side using a connecting link. To this effect, use the screws provided on the panel.

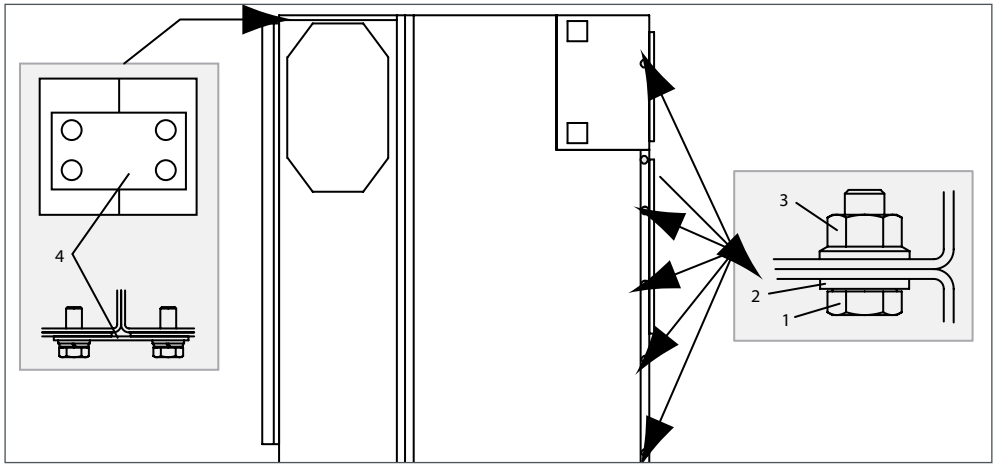


Fig. 23
Screw-fastening the panels to one another
1 Screw M8
2 Spring washer
3 Hex. nut M8 with lock washer
4 Connecting link

5 Assembly of the PIX Motor Control Center Panels (contd.)

5.7 Busbar assembly

Arrangement of busbars in branch-circuit panels

Number of busbars per phase	1 busbar	2 busbars	3 busbars
Diameter [mm²]	80 x 10	80 x 10	80 x 10
Busbar arrangement to the outgoing feeder bar			

Busbar assembly

Access to the busbar compartment: see Chapter 4.6, page 20.

Important:
Comply with the specifications on treatment of contact surfaces and the tightening torques for busbar screw fastenings in the Annex (Chapter 12 as of page 63).

- Clean all contact areas of the busbars and outgoing feeder bars in the switchgear panels and coat them with lubricant KL (see Chapter 12.2, page 63).
- Screw-fasten busbars to the outgoing feeder bar using two screws in accord. with Fig. 24. Observe location of busbars and outgoing feeder bars.

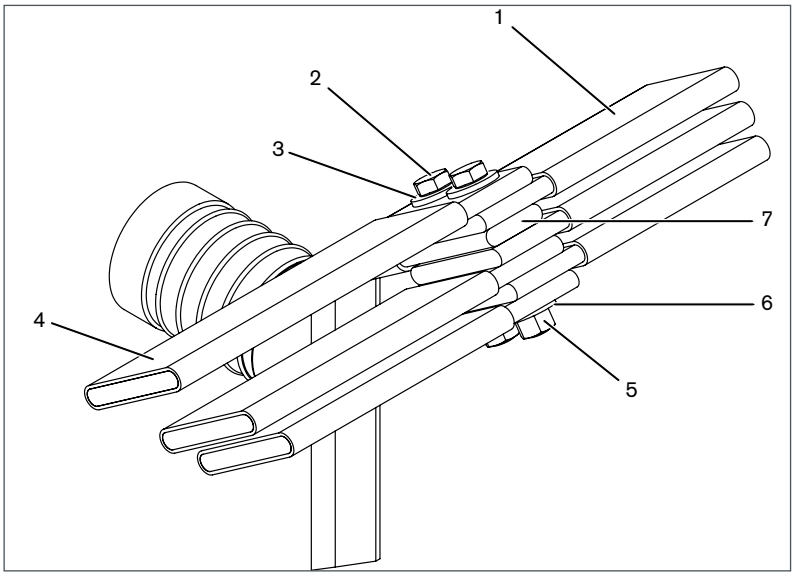


Fig. 24
Busbar assembly
1 Busbar 3x80x10
2 Screw M12
3 Spring washer
4 Busbar 3x80x10
5 Nut M12
6 Spring washer
7 Outgoing feeder bar

5 Assembly of the PIX Motor Control Center Panels (contd.)

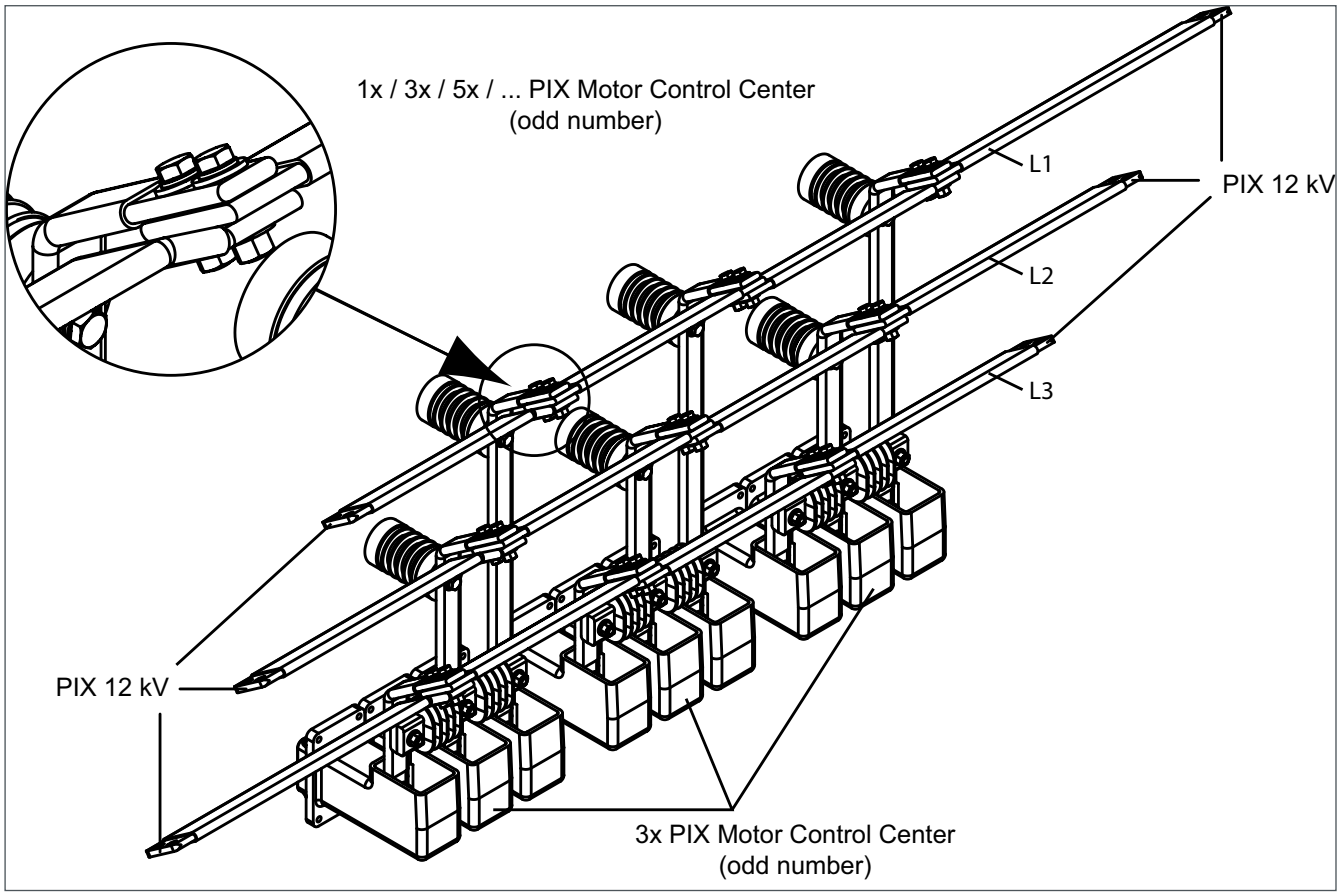


Fig. 25
Busbar attachment for PIX Motor Control Center switchgear configuration (odd number)

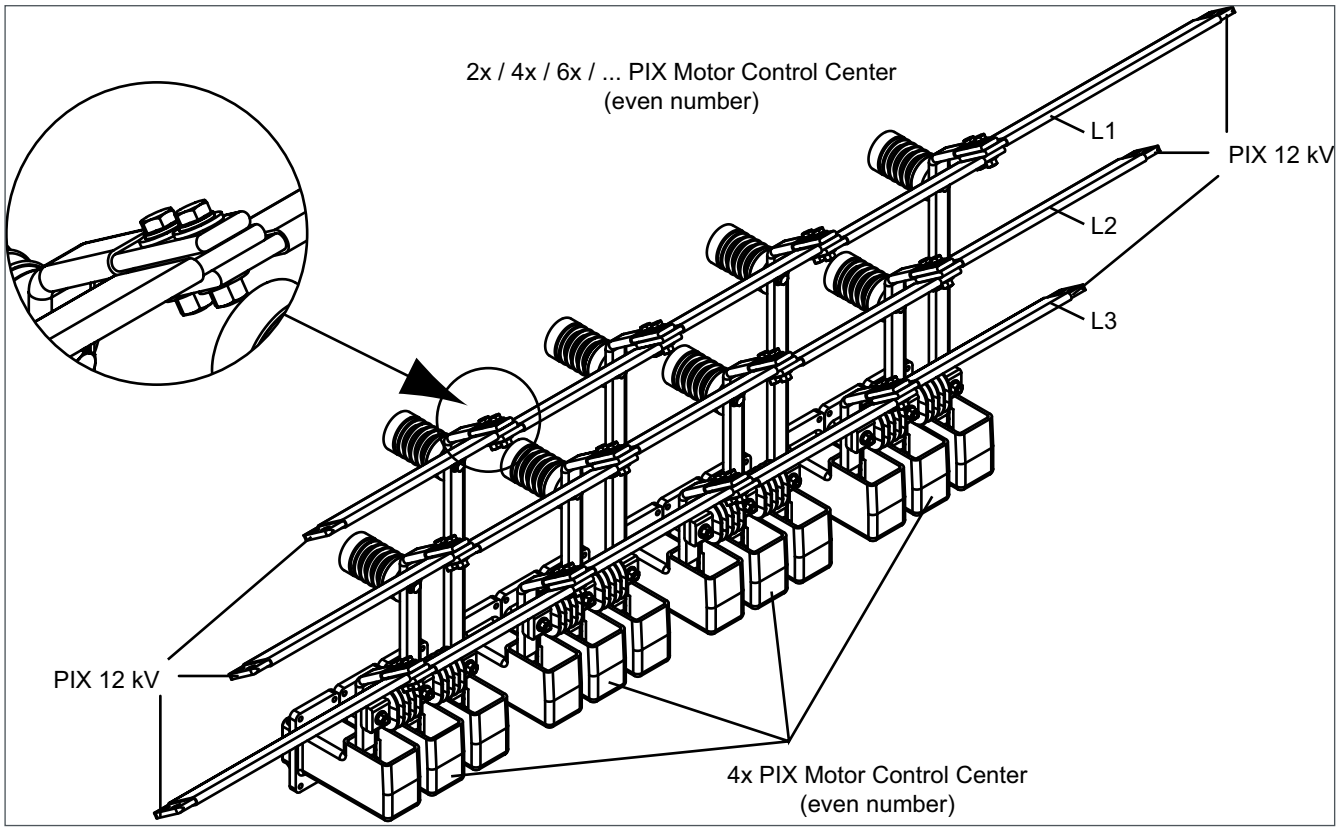


Fig. 26
Busbar attachment for PIX Motor Control Center switchgear configuration (even number)

5 Assembly of the PIX Motor Control Center Panels (contd.)

5.8 Mounting the earth bus

Important:
Comply with the specifications on treatment of contact surfaces and the tightening torques for busbar screw fastenings in the Annex (Chapter 12 as of page 63).

Connection between a PIX 12 kV circuit-breaker panel and a Motor Control Center (see Fig. 27)

- Route the earthing cable to the Motor Control Center through the cutout in the circuit-breaker panel and fix it to the copper brackets (Fig. 27, item 1). Screw fastening M8
- Screw-fasten both sides of the connecting bar (5) to the earthing cable of the circuit-breaker panel (4). Screw fastening M8

Connection between two Motor Control Centers (see Fig. 27)

- Slip the connecting bar (3) into the adjacent panel through the cutout in
- the panel.
- Screw-fasten the connecting bar, the earth bar and the copper bracket to one another (4). Screw fastening M8
- Connect the earth bus to the earthing system of the switchgear building (connecting lines and screw accessories are not included in the scope of supplies).

Observe the specific standards referring to earthing systems which apply in the country in question.

5 Assembly of the PIX Motor Control Center Panels (contd.)

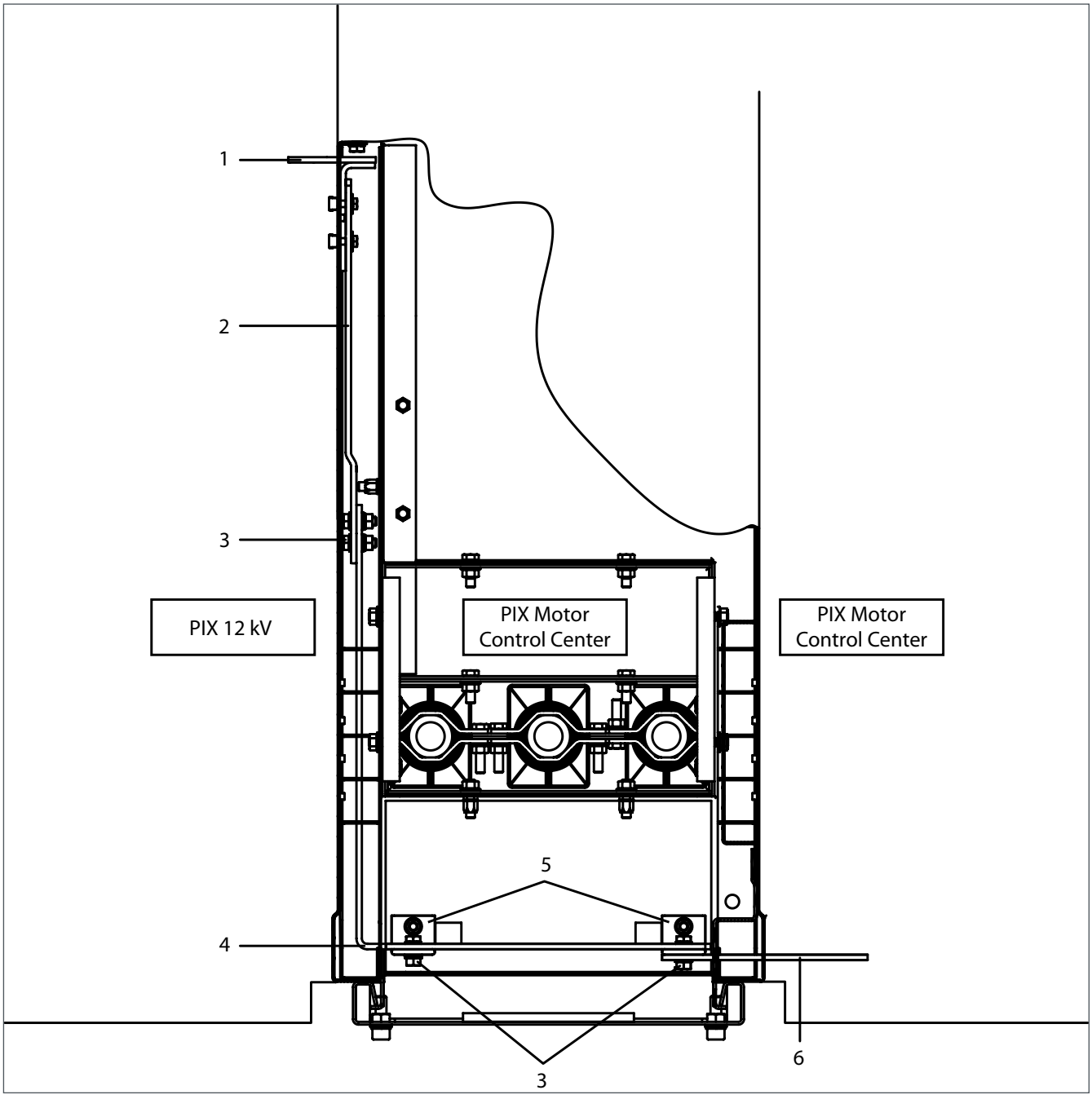


Fig. 27
Mounting the earth bus (top view)

Illustrated: Example of a panel arrangement

1 Earthing cable of the PIX 12 kV panel
2 Connecting bar to the earthing cable of the PIX 12 kV panel
3 Screw fastening M8
4 Earthing bar for a PIX 12 kV panel
5 Copper bracket for panel attachment
6 Connecting bar to another PIX Motor Control Center

6 Assembly of the PIX Motor Control Center for PIX High series

6.1 Safety provisions

The switchgear panels may only be installed and assembled by the manufacturer's staff or by persons who have been certified for this work. PIX Motor Control Center are delivered with the earthing switch ON.

Warning!
Risk of injury due to movable parts in mechanical drives. The energy-storing device of the earthing switch must not be tensioned during assembly.

Warning!
Risk of accidents! Watch out for floor openings in the switchgear room.

Warning!
The top sides of the panels are not meant to be walked on. Persons may fall through them, get injured or may damage the panel. When work has to be performed on the panel top - e.g. assembly of deflectors, fans or pressure relief ducts - temporarily position a solid base plate to step on

Warning!
Risk of injury due to non-respect of the safety provisions in Chapter 1 on page 8.

6.2 Wichtige Montagehinweise

Wichtig:
- Condensation, dirt and dust during assembly should be avoided on all accounts, in order to prevent damage to the panels.
- For assembly, observe the assembly drawings supplied with the equipment. Read them before you commence assembly work.
- For all screw connections, refer to the tightening torques specified in Chapter 12.3 on page 64 .
- Assembly of the switchgear-specific equipment (e.g. sidewalls, deflectors, pressure relief ducts, etc.) is described in the PIX High manual AGS 531502-02.

6 Assembly of the PIX Motor Control Center for PIX High series (contd.)

6.3 Requirements regarding the switchgear room

Before installing the switchgear panels, make sure that the switchgear room is checked according to the switchgear documentation (Fig. 28):

- Observe the minimum distance between the switchgear and the wall of the building.
- The load-bearing capacity of the fastening points must correspond to the weight of the switchgear (perform a stress analysis of the floor).
- Check base frame (if used) for dimensions and positional tolerances.
- Check position of floor openings for high-voltage and low-voltage cables.

Before the panel is positioned at its site of installation, check that the fastening points are level. Unevenness must not exceed ± 2 mm/meter and 6 mm difference in height over the entire locating surface.

Important:
Observe switchgear-specific space assignment plan.

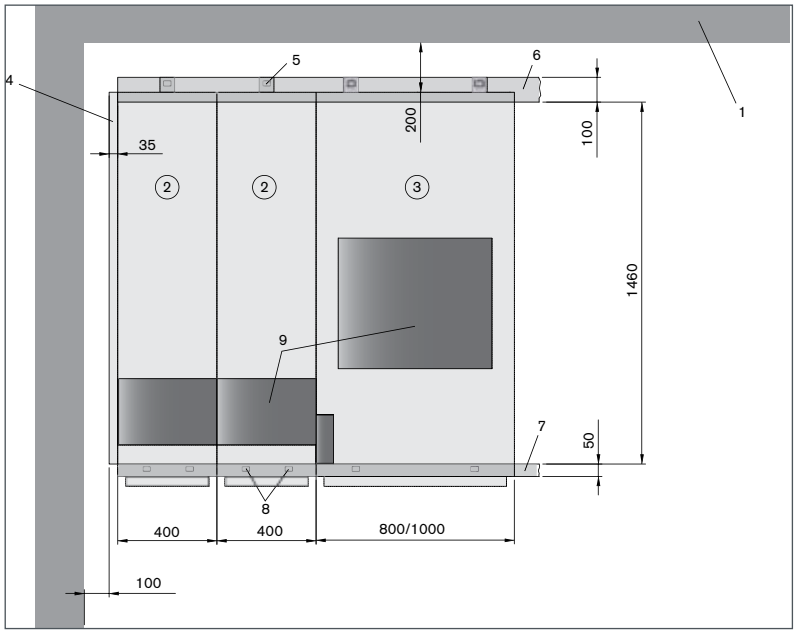


Fig. 28
Switchgear room (top view)

1 Wall of the switchgear room
2 PIX High Motor Control Center panels
3 PIX High panel 12 kV
4 Switchgear side wall
5 Rear fixation point
6 Rear base frame
7 Front base frame
8 Front fixation points
9 Floor openings for high-voltage cables

6 Assembly of the PIX Motor Control Center for PIX High series (contd.)

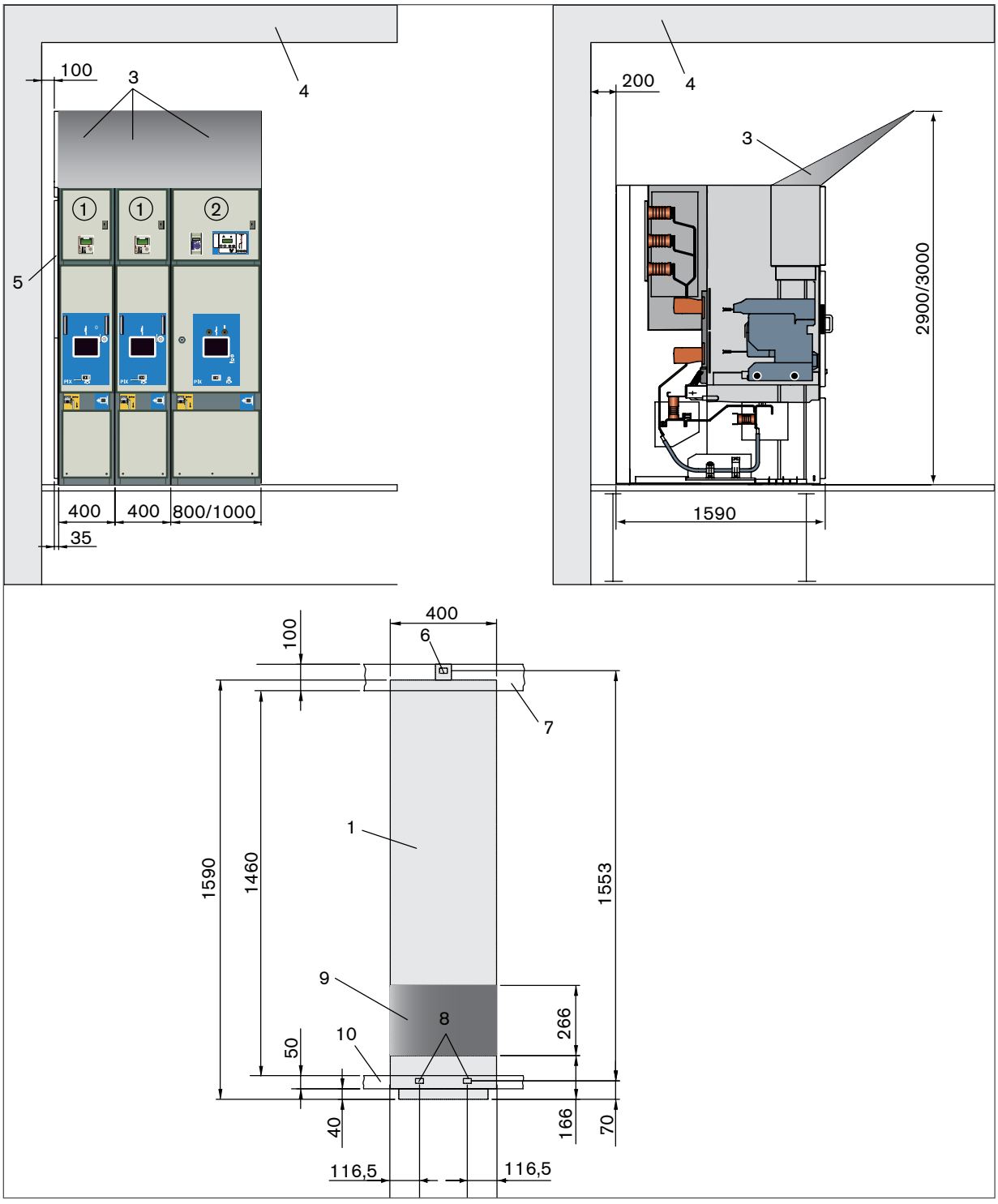


Fig. 29
Dimension drawing for PIX High Motor Control Center

1 PIX High Motor Control Center panel
2 PIX High 12 kV panel
3 Deflectors
4 Switchgear room wall/ceiling
5 Switchgear side wall
6 Rear fixation point
7 Rear base frame
8 Front fixation points
9 Floor opening for high and low voltage connection
10 Front base frame

6 Assembly of the PIX Motor Control Center for PIX High series (contd.)

6.4 Transporting the panels on the construction site

Warning!
Make sure the rope or chain is strong enough to bear the weight of the panel. Comply with the relevant provisions for hoisting equipment.

Warning!
On lowering the panels, make sure that the supporting platform is sufficiently stable and even.

Warning!
Risk of accidents. Pay attention to floor openings!

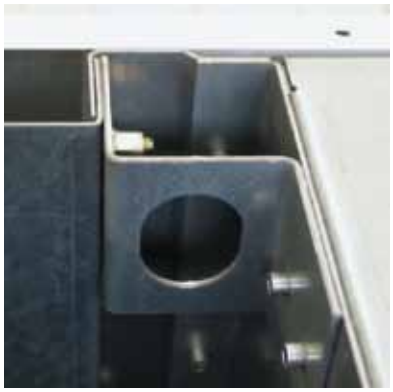


Fig. 30
Jack rings for crane transport on the panel top

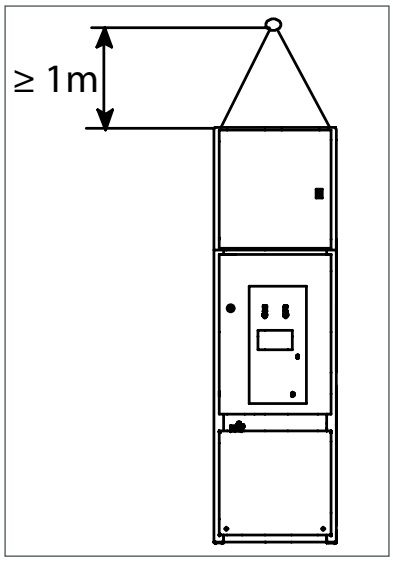


Fig. 31
Observe the minimum height

Transport of panel by means of a crane

- Attach the crane straps in the four jack rings on top of the panel (Fig. 30). Make sure to leave a minimum height of 1 m (Fig. 31).
- Release the front and rear panel screw fastening from the transport packaging. To this effect, remove the cable compartment cover (see Chapter 4.2, page 17).
- Carefully lift the panel and deposit it at the intended location.

6 Assembly of the PIX Motor Control Center for PIX High series (contd.)

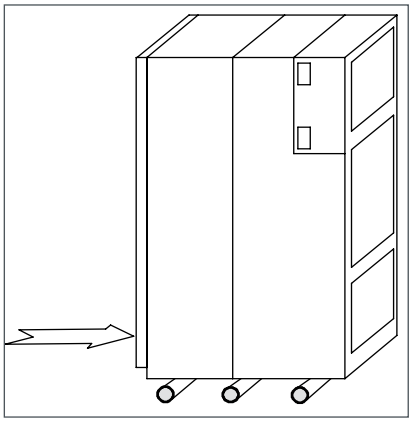


Fig. 32
Transport on rollers

Transport of the panel on the floor

- Push panel onto three cylindrical rollers (minimum diameter 30 mm) (Fig. 32).
- Thus, move the panel until it reaches its final location.

6.5 Mounting the switchgear sidewalls

Assembly drawing: AGS C73040-02
The mounting of the sidewalls to PIX MCC panels is identical with the mounting to PIX High panels.
For detailed information, please refer to PIX High manual AGS 531502-02.

6.6 Installation of panels

Fixation on the ground / base frame:

Standard version:

Assembly drawing: SEM 102173-01
Fasten the panels on the floor by two points in the front cross arm (1) and one point on the rear side (2).
The fixation is identical with the fixation of PIX High panels.
For detailed information, please refer to PIX-High manual AGS 531502-02.

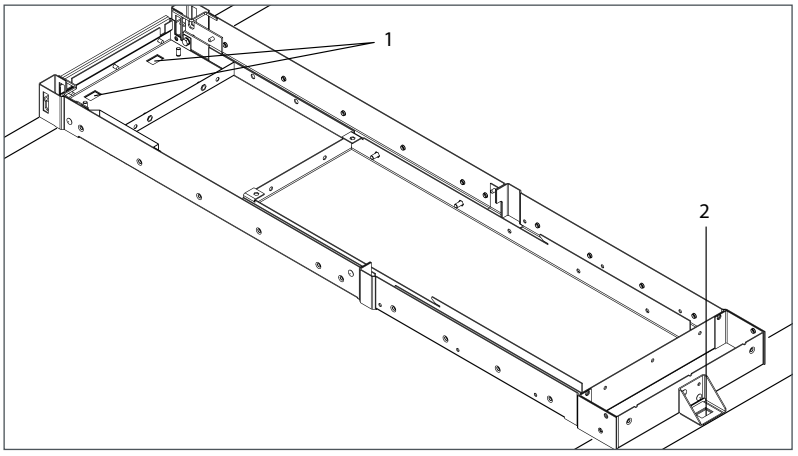


Fig. 33
1 Front fixation points
2 Rear fixation point

6 Assembly of the PIX Motor Control Center for PIX High series (contd.)

Fixation for seismic requirements:

Assembly drawing: AGS C73040-05
Fasten the panels on a base frame by two points in the front cross arm (3) and two points on the rear side (4) (screws M20).
For detailed information, please refer to the assembly drawing.

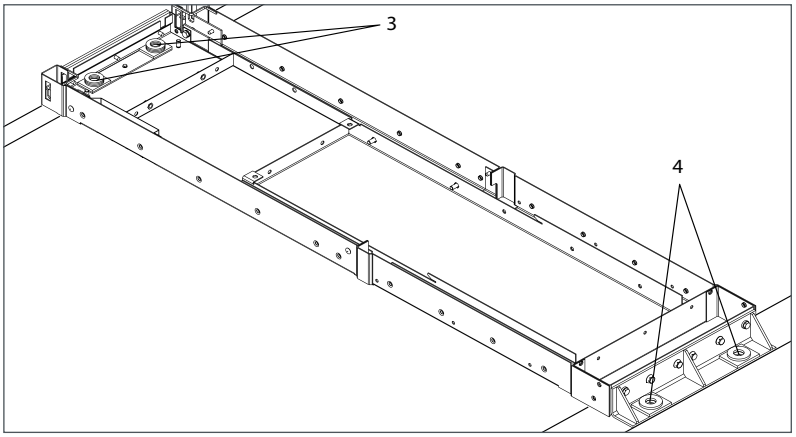


Fig. 34
3 Front fixation points
4 Rear fixation points

6.7 Screw-fastening the panels to one another

Fixation between PIX High MCC panels and between PIX High MCC panel and PIX High panel:
The fixation is identical with the fixation between PIX High panels.
For detailed information, please refer to PIX High manual AGS 531502-02

Panel interconnecting points:

Assembly drawing: AGS C73 038-01

Top cap cover:

Assembly drawing: AGS C73 479-01

Rear gap cover: (only necessary in case IAC AFLR is requested)

Assembly drawing: AGS C73 483-01

6.8 Busbar assembly

6.8.1 Access to the busbar compartment

See Chapter 4.6, page 20.

6 Assembly of the PIX Motor Control Center for PIX High series (contd.)

6.8.2 Busbar installation

Assembly drawings for busbar assembly:

Panel type	Busbar	Assembly drawing
Centre panel	In (busbar) ≤ 1250A (2x80x10)	EIB AE 1096-01
	1600A ≤ I_r (busbar) ≤ 2500A (3x80x10)	EIB AE 1096-02
	3150A ≤ I_r (busbar) ≤ 5000A (4x80x10)	EIB AE 1096-03
End panel	I_r (busbar) ≤ 1250A (2x80x10)	EIB AE 1096-07
	1600A ≤ I_r (busbar) ≤ 2500A (3x80x10)	EIB AE 1096-08
	3150A ≤ I_r (busbar) ≤ 5000A (4x80x10)	EIB AE 1096-09

Wichtig:
- Comply with the specifications regarding coating of the contact surfaces and the tightening torques for the busbar links and screw fastenings (see Chapter 12.2, page 63 and Chapter 12.3, page 64).
- Remove transport spacers and transport fixation (Fig. 35).
- Observe specified direction of screws and bolts, and correct position of nut.

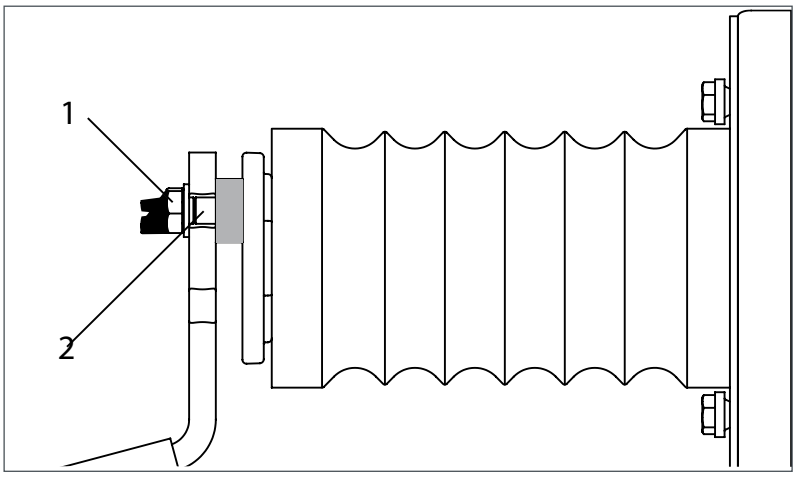
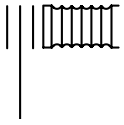
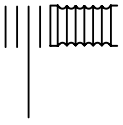
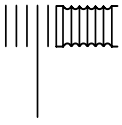


Fig. 35
1 Transport fixation
2 Transport spacers

Busbar and busbar feeder arrangement

Number of busbars per phase	2 busbars	3 busbars	4 busbars
Busbar arrangement to the feeder			

6 Assembly of the PIX Motor Control Center for PIX High series (contd.)

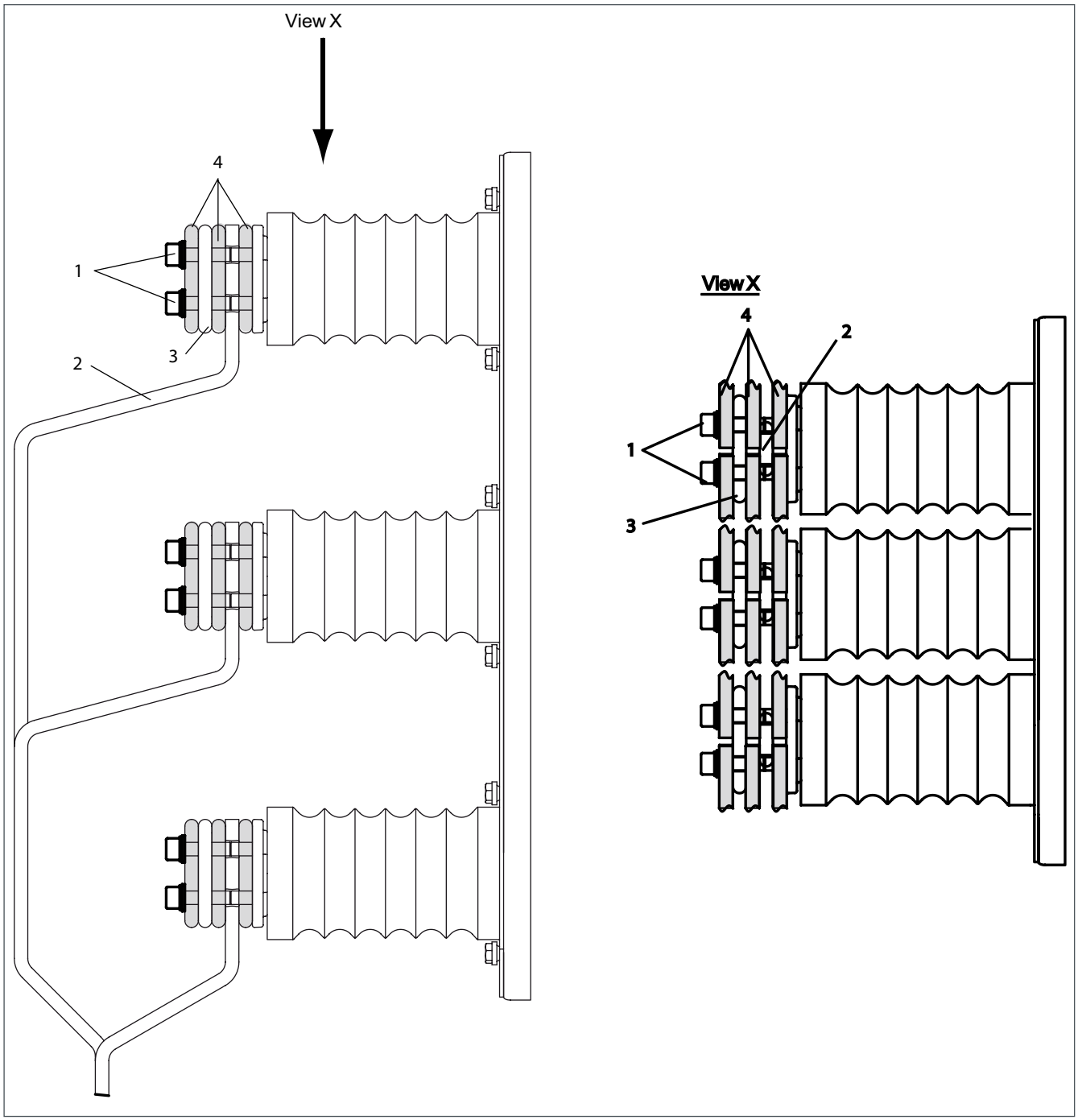


Fig. 36
Busbar link in a center panel with 3 busbars (example)
1 Screws M10 with washers and lock washers
2 Feeder bar
3 Copper intermediate layer
4 Busbars

6 Assembly of the PIX Motor Control Center for PIX High series (contd.)

6.9 Assembly of the earth bus

Assembly drawing AGS C73 030-01)
Earth bars are screw-fastened from panel to panel using connecting bars. The connecting bars are included in the accessories.
First remove the transport spacers (Fig. 37).
The assembly of the connecting bars in PIX MCC panels is identical with PIX High panels.
For detailed information, please refer to PIX High manual AGS 531502-02 .

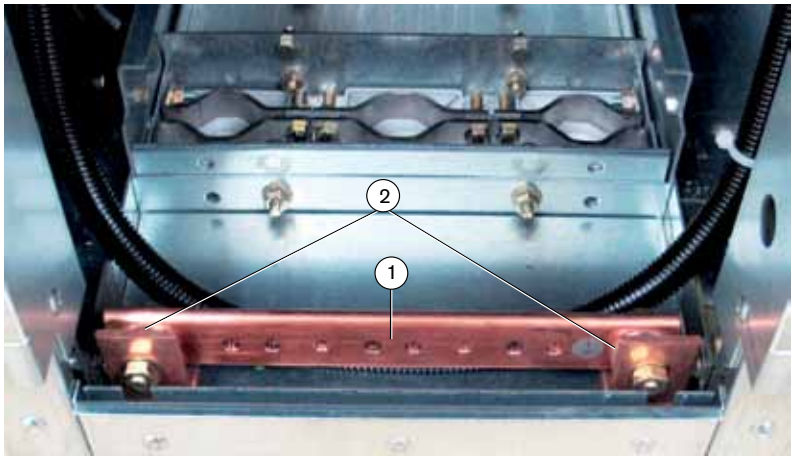


Fig. 37
Earth bus
1 Earth bar
2 Transport spacers

6.10 Mounting deflectors or pressure relief duct on top of the panel

Deflectors or a pressure relief duct are necessary to ensure personal safety in case of internal faults in accordance with IEC 62271-200.
The mounding to PIX MCC panels is identical with the mounting to PIX High panels.
For detailed information, please refer to PIX High manual AGS 531502-02.

7 High-voltage connection

7.1 Connection of high-voltage cables

Access to cable compartment: see Chapter 4.2, page 17.

Preparation of cable compartment

- Remove cable clamps (Fig. 38, item 1) and take out rubber sleeves (2).
- If necessary, remove the base plates.

Mount cable box

- Route the individual cables outwards through the cable compartment of the panel to enable assembly of the cable ends.
- Cut the rubber sleeves to fit the cable diameter, and push them onto the cables (Fig. 39).
- Strip cable ends and assemble the cable box as specified by the cable manufacturer.

Warning!
Danger due to contact corrosion in case of inadmissible matching of materials! Do not use aluminium cable lugs for the cable connection.

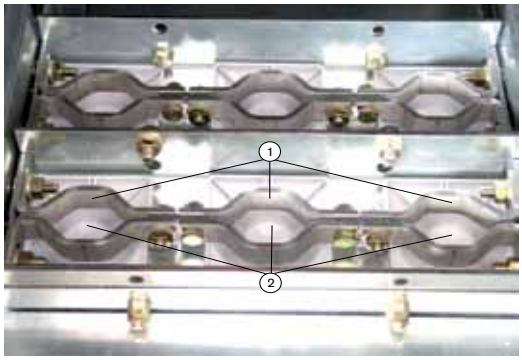


Fig. 38
Floor opening for high-voltage cables in the floor of the cable compartment
1 Cable clamps
2 Rubber sleeves

Fig. 39
Cut rubber sleeves to size and slip them onto the cables

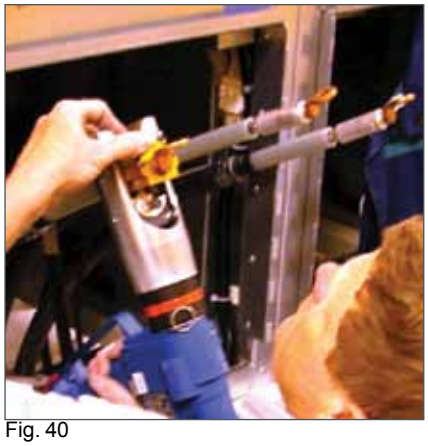


Fig. 40
Mount cable lug

7 High-voltage connection

(contd.)

Fig. 41
Cable compartment with the high-voltage cables connected (plastic screen not shown)
3 Earthing connection of the cable screen
4 High-voltage connection
5 Clamps with rubber sleeves

Important:
- Unless otherwise specified by the cable manufacturer: Comply with specified tightening torques (Chapter 12.3, page 64) and pre-coat contact areas (Chapter 12.2, page 63).
- Observe phase grouping of the switchgear panel.

- Fasten the individual cables to the appropriate connection areas.
- Re-mount the base plates.
- Fasten high-voltage cable to the floor opening using clamping assemblies (Fig. 41, item 5).
- Connect earth screens (2) of the cables to the panel (3).

Cable connection and surge arrester

If two cables are connected per phase, arrange and mount the cables as shown in Fig. 42.

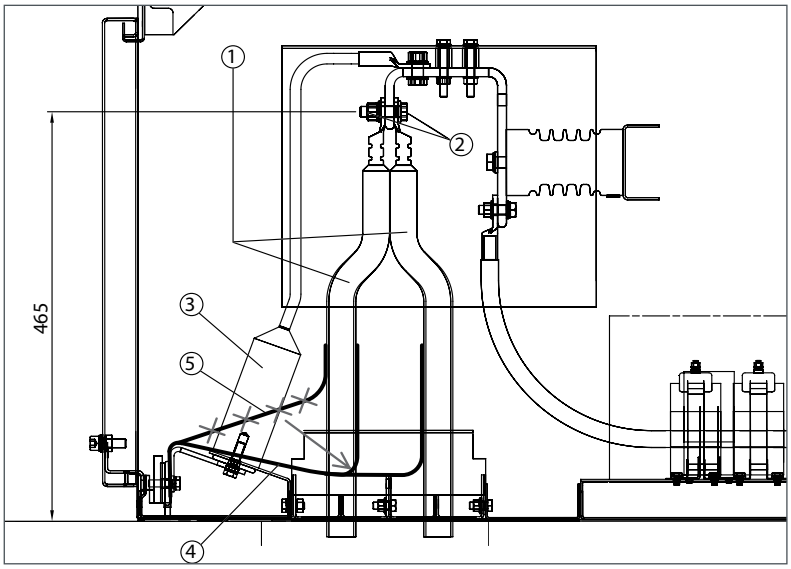


Fig. 42
Assembly of 2 cables per phase
1 High-voltage cables
2 Cable connection
3 Surge arrester
4 Regarding the surge arresters, the cable earth screens must be positioned according to the illustration.

Cable fastening for 3-conductor cable

A maximum of two 3-conductor cables can be fastened using the clamps. The fastening insert is screwed-in instead of the standard model, increasing the cable connection area by 150 mm towards the cable basement (Fig. 43).

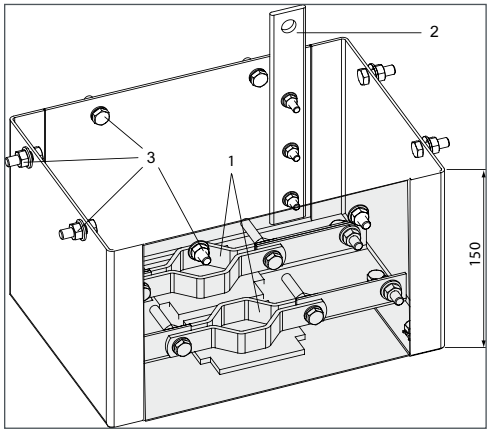
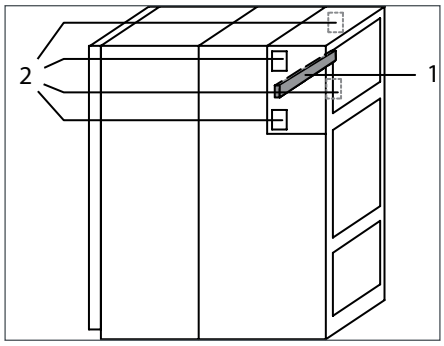
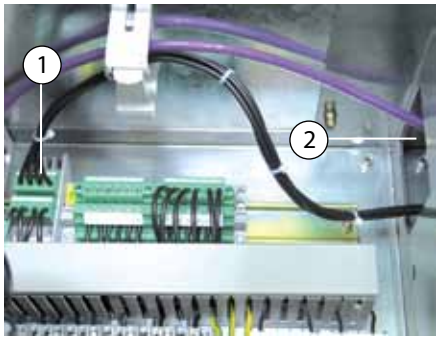


Fig. 43
Cable fastening for 3-conductor cable
1 Clamps
2 Earth conductor
3 Screw-fastening to the panel (8 screws)

8 Low-voltage connection





8.1 Connecting the ring circuits in the low-voltage compartment

- Open the door of the low-voltage cabinet using a double-bit key.
- Route the cables to the adjacent panel through the bushings (Fig. 44, item 2) of the low-voltage compartment.
- Connect the ring circuits to the terminal strip according to the circuit diagram.

8 Low-voltage connection

(contd.)

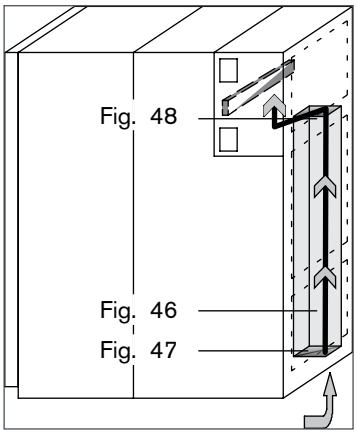


Fig. 45
Placing external connections

8.2 Connecting external cables

External cables supplied by the customer may be routed upwards to the low-voltage compartment through the right-hand cable duct inside of the panel (Fig. 45).

- Remove the protective cover of the cable duct in the panel (Fig. 46) (3x nuts M6, wrench size 10 mm).
- Open the four cut-outs required for the cable bushings (Fig. 47).
- Route the cable through the cable duct to the low-voltage cabinet (Fig. 48).

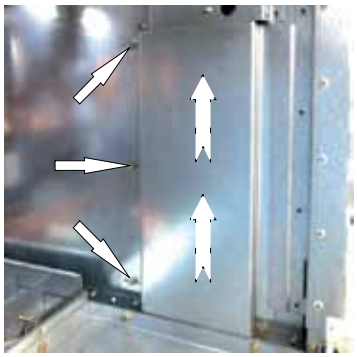


Fig. 46
Removing the protective cover

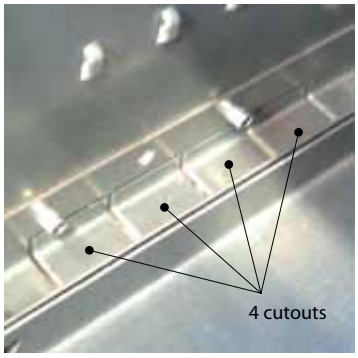


Fig. 47
Cut-outs for cable bushings

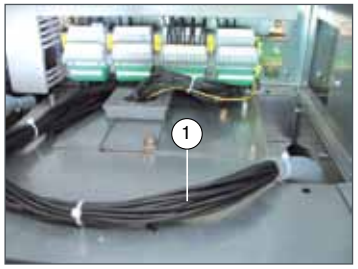


Fig. 48
Connecting external cables (1) in the low-voltage compartment

9 Final steps / commissioning

9.1 Final steps

Danger!
The high-voltage supply must not be connected. All active parts must be earthed.

Important:
- Whenever you detect anomalies, faults or malfunctions, do not commission the switchgear, but inform the manufacturer.
- For switching operations, comply with Chapter 10 ”Operation” as of page 48.
- In case supply voltage is not available, the vacuum contactor CVX cannot be actuated.

Cleaning the panel and checking panel assembly

- Clean the switchgear, removing contamination resulting from assembly work.
- Remove the transport securing device of CVX truck (Chapter 4.3.1 as of page 18).
- Remove all the attached information tags, cards, brochures and instructions no longer needed.
- Check the tightening torques of all screw fastenings and connections established on the site of installation:
  - High-voltage connection
  - Earth conductor
  - Busbar links
  - Panel screw fastenings
  - Low-voltage wiring
  - Special attachments

Damaged paint

The panels are powder-coated. Minor damage to the paint can be repaired using commercially available paint (standard colour RAL 7044 or customized colour).

Inspection

- Check the switchgear for damage which might be due to transport or assembly work.
- Compare data on nameplate to the required ratings.
- Check data of high-voltage fuse for the CVX.
- Check striker position and correct assemby of the high-voltage fuse in the CVX.
- Check phase coincidence of the cables connected (see Technical Manual PIX panels with circuit-breaker).

Re-mount the covers:

- Demounted partition and cover plates in the busbar and switching device compartments.
- Cable duct covers of the external control and measurement cables.
- Cable compartment cover (see Chapter 4.2, page 17)
- Remove temporary base from the panel top, if such a base has been used (see Chapter 4.6, page 20).

Racking-in truck CVX

See Chapter 4.5, page 19.

Re-fastening the cover of the switching device compartment

See Chapter 4.3.1, page 18.

9 Final steps / commissioning

(contd.)

9.2 Checking switching functions and interlocks

Danger!
The high-voltage supply must not be connected. All active parts must be earthed.

Important:
- For switching operations, comply with Chapter 10 ”Operation” as of page 49.
- In case supply voltage is not available,
  - blocking coils (optional) are in locked position; manual switching operations are thus blocked;
  - electrical actuation of the vacuum contactor CVX is not possible.

- Apply supply voltage.
- Operate truck and earthing switch manually.
- Check switch position indicators.
- Check electrical functions of control and operating devices:
  - closing and opening function for the vacuum contactor CVX
  - optional motor-operated drive for the earthing switch
- Check switch position indicators and interlocks (see Chapter 10 as of page 49).

9.3 Power frequency test of busbar (optional)

Warning!
Comply with the safety provisions in Chapter 1, page 8 .

A test unit and a test adapter (not included in scope of supplies) are required for the power frequency test.

Preparation

- All panels must be isolated from the power supply and earthed (Fig. 49).
- Busbar: Disconnect voltage transformer (MTX) and surge arrester. Earth voltage detection systems.
- Incoming feeder panel for voltage test: Remove cable compartment cover and disconnect voltage transformer and surge arrester. Earth voltage detection systems.

Important:
Make sure that no high-voltage cables are connected. Observe the assembly and operating instructions for the test unit and the test adapter.

9 Final steps / commissioning

(contd.)

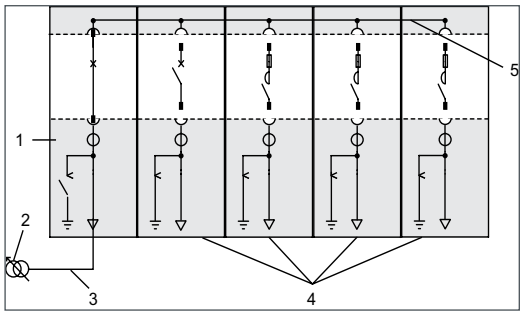


Fig. 49
Switch position during the power frequency test (example: five panels)
1 Incoming feeder panel for test voltage
2 Test unit (e. g. high-voltage source, test transformer)
3 Test cable
4 Branch-circuit panels
5 Busbar

Performing the power frequency tests

- Perform the power frequency test of the busbar on the feeder panel:
  - Connect test unit to the test cable.
  - Switch the earthing switch OFF.
  - Move circuit-breaker into service position and switch ON.
  - Perform the power frequency test successively for all three phases (L1, L2, L3) in accordance with the specifications of the test unit manufacturer. Make sure to earth the adjacent phases.

Important:
Observe admissible test values for the switchgear and the admissible test values for power-frequency tests after installation of the switchgear in accordance with IEC 62271-200.

After the power frequency test

- Switch circuit-breaker OFF and put it into disconnected position; switch earthing switch ON.
  - Remove test unit and test cables.
  - Reconnect disconnected voltage transformers and surge arresters.

9.4 Cable test after assembly

Warning!
Comply with the safety provisions in Chapter 1, page 7.

Admissible limits for the switchgear in case of cable tests available on request from the manufacturer's.

During the cable test, the busbar can be operated at rated voltage (see nameplate Chapter 2.5, page 11). For qualification of the current transformers for cable tests, enquire at the appropriate manufacturer's.

A test unit and a test adapter (not included in scope of supplies) are required for the cable test.

Important:
Observe the assembly instructions for the test adapters and the operating and inspection instructions for the test unit.

Preparation

- Isolate outgoing feeder cable of the panel which is to be tested.
- Isolate outgoing feeder cable in remote station.
- Earth outgoing feeder cable of the panel which is to be tested.
- Remove cable compartment cover (see Chapter 4.2, page 16).
- Disconnect voltage transformer and surge arrester; earth voltage detection systems.

Performing the cable test

- Connect the test adapter to a free cable connection in the panel and on the test unit. To this effect, observe the specifications of the test unit's manufacturer.

9 Final steps / commissioning

(contd.)

Important:
Make sure that the metallic components of the test adapter are at a sufficient distance from the earthed switchgear components (e.g. housing).

- Set switchgear panel to test position: Switch the earthing switch OFF.

Vacuum contactor CVX: OFF
Truck: in disconnected position
Earthing switch: OFF

- Perform cable test according to the cable manufacturer's specifications. When doing so, do not exceed the admissible limits.

After the cable test

- Earth outgoing feeder cable again.
- Remove test set.
- Reconnect voltage transformer, surge arrester and voltage detection systems or de-earth them.
- Reposition cable compartment cover (see Chapter 4.2, page 17).

10.1 Operating interface of the panel

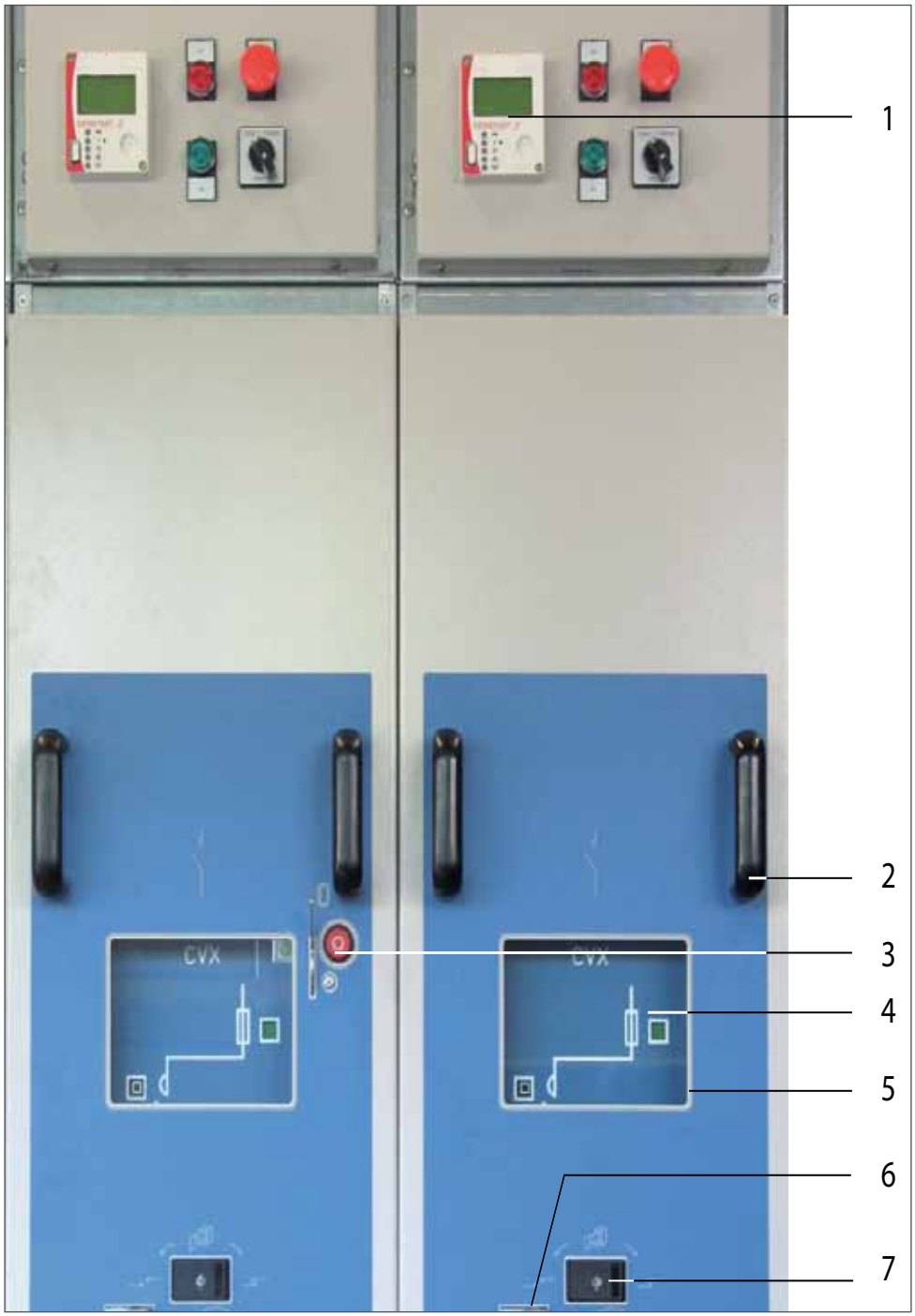


Fig. 50
Operating interface of the panel
* only in case of CVX truck with manual tripping (drive mechanically latched)
1 Combined monitoring and motor protection device GEMSTART
2 Front cover with handle
3 OFF push-button (optional) *
4 Vacuum contactor CVX
5 Inspection port
6 Interlocking slide for manual actuation of the truck
7 Locking mechanism for switching device compartment cover via double-bit key
8 Insertion opening for racking the truck in/out manually
9 Earthing switch position indicator
10 Interlocking slide for manual actuation of the earthing switch
11 Insertion opening for manual actuation of earthing switch

10.2 Truck vacuum contactor CVX

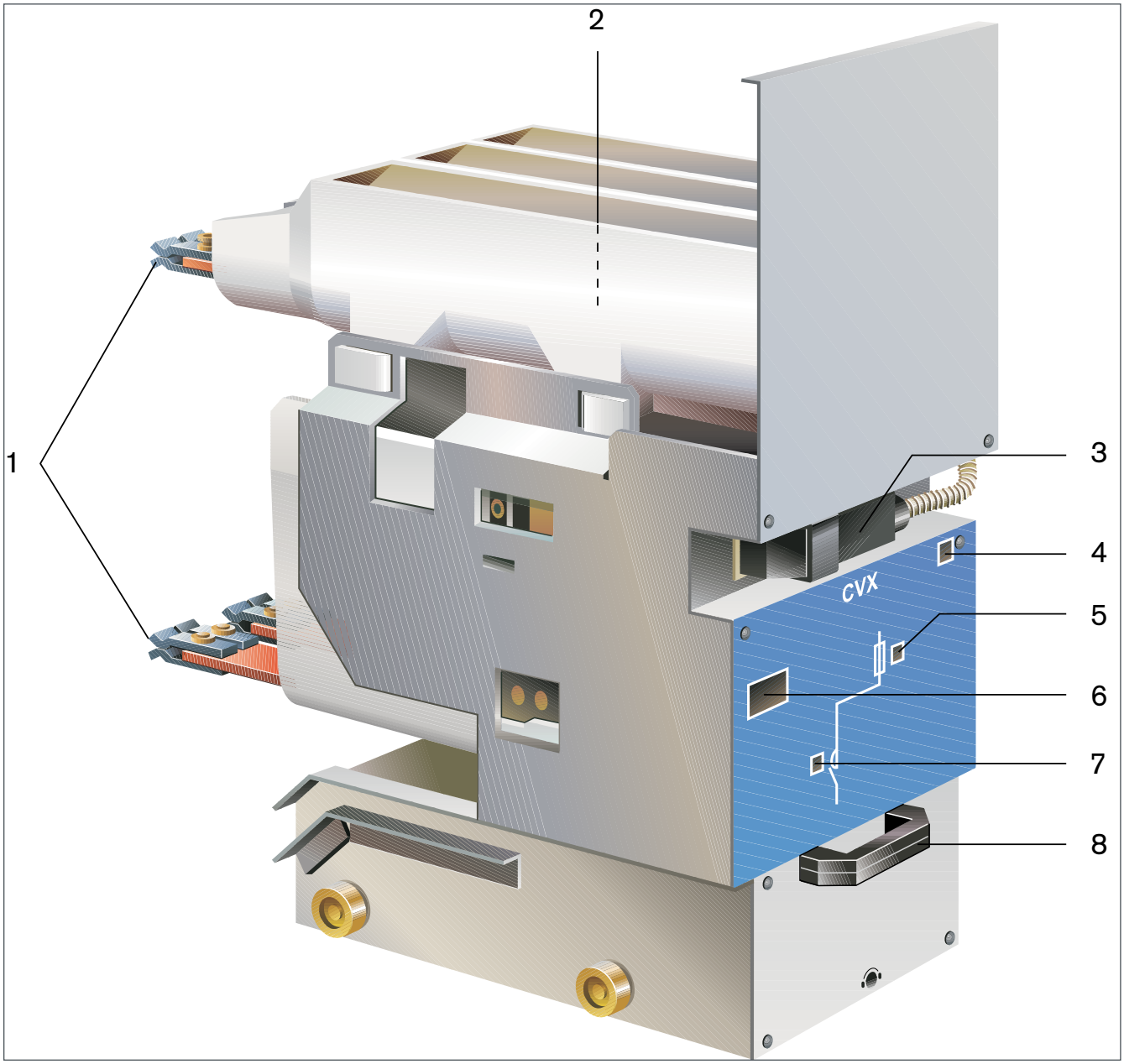
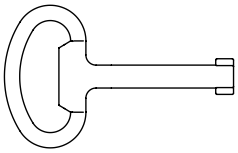
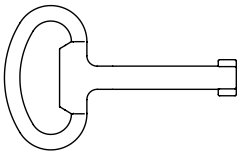
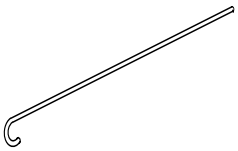
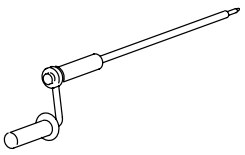


Fig. 51
Vacuum contactor CVX
* Drive is mechanically latched
1 Moving contacts
2 Fuses
3 Low-voltage connector
4 Manual tripping (optional) *
5 Fuse trip indicator (green/red)
6 Counter (optional)
7 Position indicator I - O
8 Handle

10 Operation (contd.)

10.3 Operation accessories

Important:
- These accessories are supplied with the panel. The panel may only be operated by means of these accessories.

Designation	Item no.	Illustration
Double-bit key for the switching device compartment cover	SEM101137-01	
Double-bit key for the low-voltage compartment	SEM101137-02	
Operating rod to switch the vacuum contactor CVX off manually (optional)	AGS H35446-01	
Operating lever for earthing switch	AMT 000223-09	
Crank for truck	AGS H31601-01	

10.4 Interlocks

Important:
Complete switchgear interlocking can only be ensured with complete locking devices.

If no mechanical or electromagnetic interlocks are available for switchgear interlocking, mechanical lock-outs with cylinder or padlock must be provided.
PIX Motor Control Center have mechanical basic interlocks which help avoid operating errors.
You must be familiar with these interlocks before operating panels.

10.4.1 Mechanical interlocks

Interlock	Function of interlock	Method of operation of interlock
Between truck and low-voltage connector	The truck cannot be actuated unless the lowvoltage connector is inserted	The opening for the moving crank handle is locked
Between truck and earthing switch	The truck cannot be moved into service position while the earthing switch of the switchgear panel is in “ON” position	The moving crank handle is uncoupled automatically.
	The earthing switch cannot be switched on once the truck has left its disconnected position.	The rotary movement of the earthing switch lever is blocked. Do not apply force!
Between the cable compartment cover and the earthing switch (optional)	The cable compartment cover can only be removed if the earthing switch is ON.	The cable compartment cover is locked mechanically by means of a sheet metal plate.
Between the truck and the switching device compartment cover (optional)	The switching device compartment cover can only be opened if the truck is in its disconnected position.	The switching device compartment cover cannot be lifted via the opening handle unless the truck is in disconnected position.
	If the switching device compartment cover is opened, the truck cannot be moved into service position.	The crank of the truck cannot be inserted if the switching device compartment cover is open.
Between truck and operating state of the vacuum contactor	The truck cannot be racked in or out while the vacuum contactor is switched on.	The opening for the moving crank handle is locked.
	The vacuum contactor cannot be switched on unless ■ it has completely reached its disconnected or service position and ■ the operating crank for the rack-in mechanism has been removed	The vacuum contactor cannot be switched on or off.

10.4.2 Electromagnetic interlocks (optional)

Electromagnetic blocking coils can be used for inter-panel as well as intrapanel interlocks:
- Manual actuation of the disconnector truck is blocked.
- Manual actuation of the earthing switch is blocked.

Important:
- In case of failure of the supply voltage, all electrical interlocks are in their ”locked” position. Measure: Re-establish the supply voltage.
- Please note the switchgear-specific circuit diagram as regards the design of the interlocking systematics.

Fig. 52
Mechanical lock-out of earthing switch via padlock

10.4.3 Lock-out by means of padlocks (not included in the scope of supplies)

The boreholes are provided for padlock yokes of Ø ≤ 8 mm.

Fig. 53
Padlock on truck

Fig. 54
Mechanical lock-out for shutter (same principle for left-hand and right-hand sides)

Fig. 55
Interlocking of truck via padlock (optional)

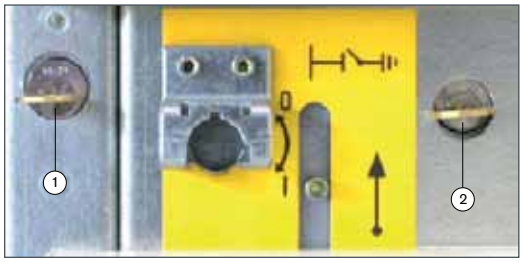


Fig. 56
1 Interlocking of earthing switch in closed condition
2 Interlocking of earthing switch in open condition

10.4.4 Interlocks by means of cylinder locks (optional)

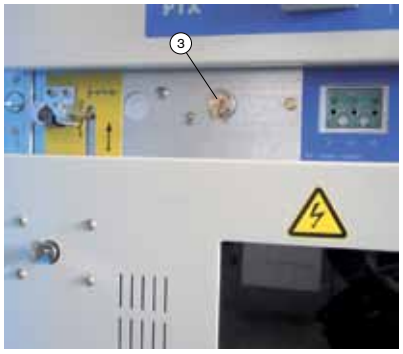


Fig. 57
3 Truck interlock

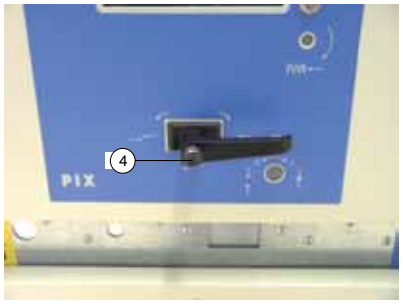


Fig. 58
4 Interlock of the switching device compartment cover

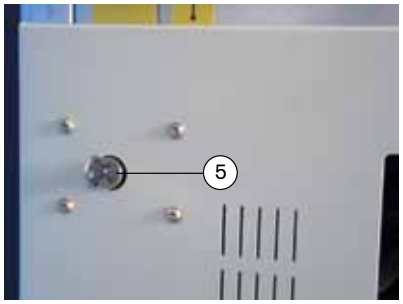


Fig. 59
5 Interlock of the cable compartment cover

10.5 Operating specifications

The switchgear unit may only be operated by specialist electricians who have proven experience (training certificate) in conjunction with the PIX series and all the relevant safety standards.
Refer also to the safety provisions in Chapter 1, page 7.

Warning!
To rule out faulty switching operations, the operating sequences described below must be complied with. Each switching operation must be completed.

Important:
- After each switching operation for which you have used a crank or a lever, remove this tool and store it in the tool board.
- In case supply voltage is not available,
  - blocking coils (locking the interrogation slides, depending on design) are in “locked” position;
  - the vacuum contactor CVX can no longer be actuated electrically.

Measure: Re-establish the supply voltage.

10.6 Switching the vacuum contactor

Position indicator

Whether the vacuum contactor CVX is switched ON or OFF is indicated directly on the device (Fig. 60 and Fig. 61).

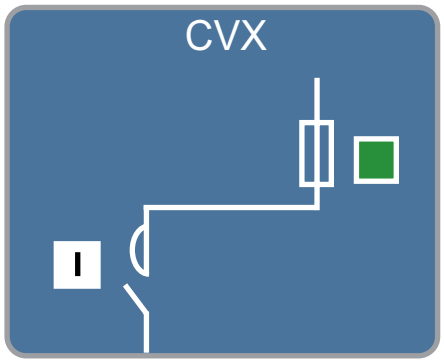


Fig. 60
I Vacuum contactor switched ON

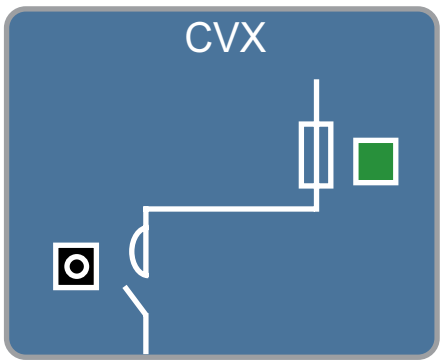


Fig. 61
O Vacuum contactor switched OFF

Switching

The vacuum contactor CVX is switched on and off only by means of a remote control device or the monitoring and motor protection device GEMSTART.
A separate manual is provided for GEMSTART.

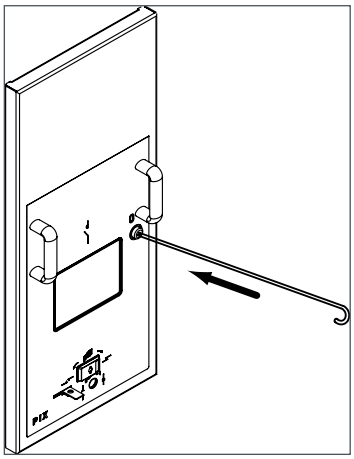


Fig. 62
Switching OFF the vacuum contactor by means of an operating rod

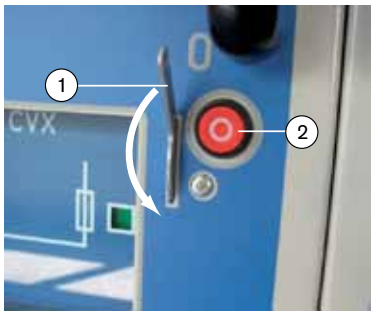


Fig. 63
Switching OFF the vacuum contactor by means of a push-button
1 Push-button extension
2 Push-button OFF

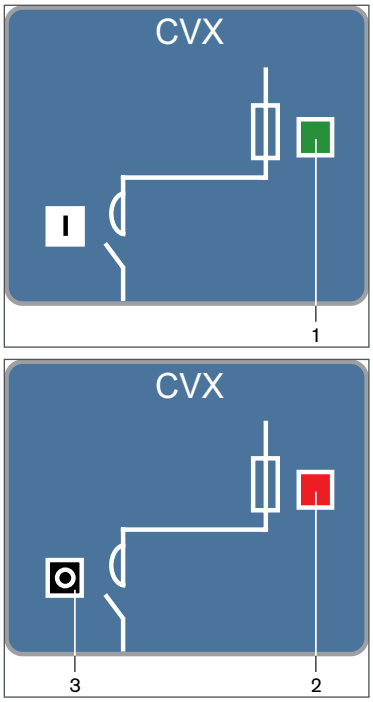


Fig. 64
Fuse trip indicator
1 green: fuses OK
2 red: one or several fuses have tripped
3 vacuum contactor has switched off automatically

Switching OFF manually (optional)

This feature is only available for mechanically latched vacuum contactors CVX. In this case, the vacuum contactor CVX can be switched off directly on the panel (Fig. 62 and Fig. 63).

- Put the operating rod (see Chapter 10.3, page 51) through the guide hole in the switching device compartment cover until the vacuum contactor switches off automatically (Fig. 62). Check the position indicator (Fig. 61, page 54).
- Alternatively: switch OFF via push-button (Fig. 63). To this effect, move the push-button extension (1) downwards to its stop and press the push-button O (2). Check the position indicator (Fig. 61, page 54).

10.7 Fuse tripping

The inspection glass of the vacuum contactor on the panel front indicates the status of the fuses (Fig. 64):

Measures to be taken in case of fuse tripping

- Rack the vacuum contactor CVX out of the panel (see Chapter 4.5, page 19).
- Always exchange all 3 fuses. Fuse replacement is described in the Operating Manual of the vacuum contactor CVX (no. NTV 132 2E).

10.8 Moving the truck into disconnected/ service position

Initial situation:

- Vacuum contactor CVX OFF
- Earthing switch OFF

Moving the truck from operating into disconnected position

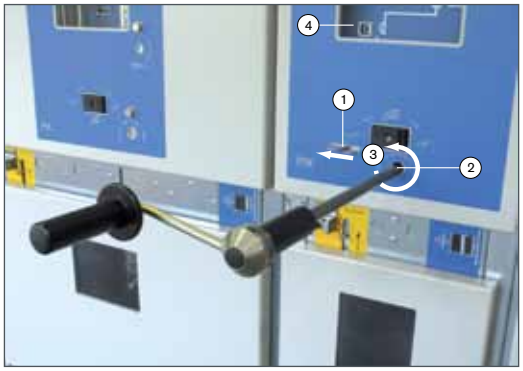


Fig. 65
Moving the truck from operating into disconnected position

- Push the interlocking slide (Fig. 65, item 1) to the left to open the crank insertion opening.
- Insert operating crank incl. the integrated slip coupling (2) and move it counter-clockwise to its stop or until the slip coupling reacts (3); the vacuum contactor moves to its disconnected position. Check the position of the vacuum contactor in the panel through inspection port (4).
- Remove crank.

Moving the truck from disconnected into service position

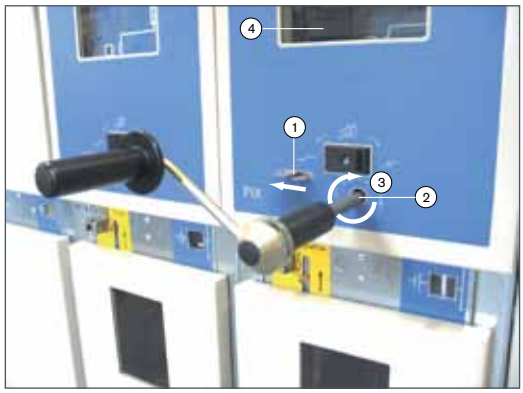


Fig. 66
Moving the truck from disconnected into service position

Push the interlocking slide (Fig. 66, item 1) to the left to open the crank insertion opening.

- Insert operating crank incl. the integrated slip coupling (2) (see Chapter 10.3, page 51) and move it clockwise to its stop or until the slip coupling reacts (3); the vacuum contactor moves to its service position. Check the position of the vacuum contactor in the panel through inspection port (4).
- Remove crank.

10.9 Operating the earthing switch manually

Initial situation

- Vacuum contactor CVX OFF
- Truck in disconnected position

10.9.1 Switch earthing switch ON

- Push the slide (Fig. 67, item 1) upwards and insert the control lever of the earthing switch with the lever rod pointing up (2).
- Turn the lever clockwise by approx. 95° (3).
- Check position indicator. It must indicate that the earthing switch is ON (Fig. 68, item 4). Remove crank.

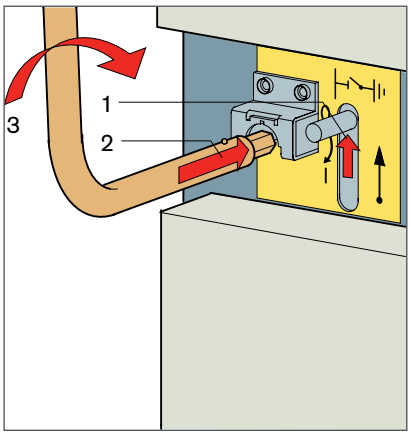


Fig. 67
Switch earthing switch ON:
1 Press slide upwards
2 Insert control lever
3 Turn control lever clockwise

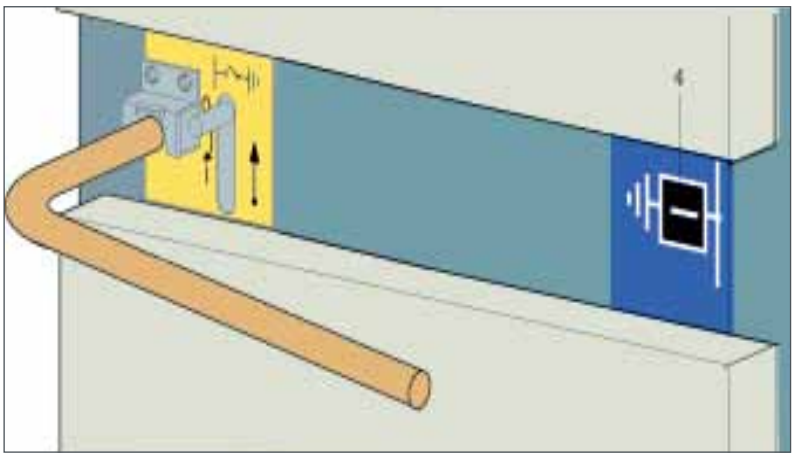


Fig. 68
4 Position indicator indicates: Earthing switch is turned ON

10.9.2 Switch the earthing switch OFF

- Push the slide (Fig. 69, item 1) upwards and insert the control ever of the earthing switch with the lever rod pointing to the right (2).
- Turn the lever counter-clockwise by approx. 95° (3).
- Check position indicator: It must indicate that the earthin switch is OFF (Fig. 70, item 4). Remove crank.

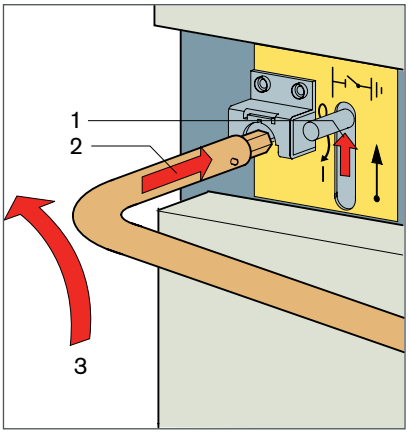


Fig. 69
Switching the earthing switch OFF:
1 Press slide upwards
2 Insert control lever
3 Turn control lever counter-clockwise

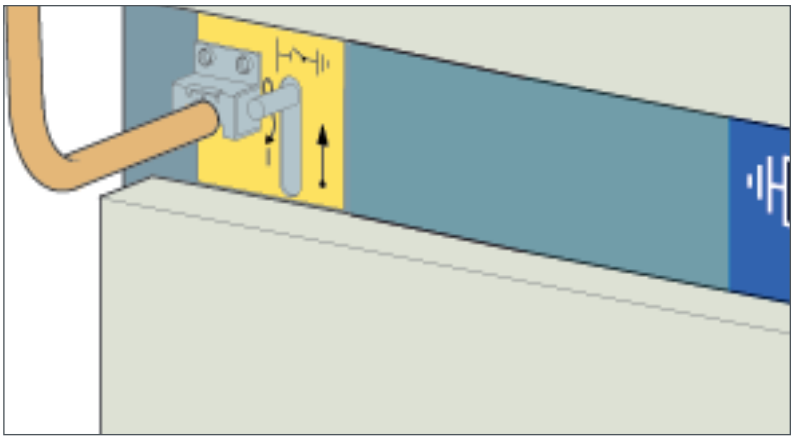


Fig. 70
4 Position indicator indicates: earthing switch is OFF

11 Maintenance

11.1 Safety provisions

Only specialist electricians certified by the manufacturer for maintenance work and who have the required knowledge regarding handling of medium-voltage switchgear of the series PIX and all the relevant safety provisions are permitted to perform maintenance and cleaning work.

Warning!
Comply also with the safety provisions in Chapter 1, page 7.

11.2 Maintenance schedule

PIX series indoor switchgear has been designed for normal operating conditions in accordance with IEC 62271-1.

Visual inspection

It is recommended to check the panels visually at regular intervals depending on the strain they are subject to during operation and in accordance with the national regulations.

Important:
In case of frequent condensation or air pollution (dust, smoke or corrosive gases), the maintenance intervals must be adapted to the actual conditions.

A visual inspection includes a complete check of the panels for contamination, condensation and damage, to be performed by certified staff.
If there are signs of contamination or condensation, the panels must be cleaned in an expert manner (see Chapter 11.3, page 60, and Chapter 11.4, page 60) and subsequently the drives, interlocks and position indicators checked for proper functioning (see Chapter 10, page 49).
If damage is detected on the panels, these must be repaired or components be replaced (see Chapter 11.5, page 59, and Chapter 11.6, page 60).
For cleaning and maintenance work, please refer to Chapter 4 ”Access to the main circuit compartments” as of page 16.
In case of ambiguities or irregularities, please contact the manufacturer’s Service Center immediately.

Mantenance interval	Work to be carried out	Qualification / Work performed by
12 years	■ Clean and grease drives and movable main current contacts (see Chapter 11.7, page 61). ■ Check releases and blocking coils for proper function.	Staff who have been certified for this work.
After 1,000 actuations of the truck or the earthing switch	Revision of the switching device in question	Manufacturer’s Service Center
Vacuum contactor CVX	see Technical Manual NTV 132 2E	

11.3 Cleaning

Warning!
Risk of injury: the drives must not be disassembled for service and maintenance work.

To ensure the specified insulating level, the insulating components must be clean. On principle, cleanliness deserves utmost attention.
When deposited dirt is detected, the panels must be cleaned in an expert manner.
When cleaning, make sure that the lubrication in the drive mechanisms is not removed. If the drive mechanisms are no longer sufficiently lubricated, new lubrication must be applied.

Slight contamination:

Clean using a dry, lint-free cloth. Depending on the degree of soiling, replace cloth as often as necessary.

Serious contamination:

Cleaning agent, 1 l can (see Chapter 12.1, page 62). The use of other cleaning agents is not admissible.
- The operator should wear protective gloves.
- Use cleaning agent according to manufacturer's instructions.
- Soak the cloth thoroughly and wipe the insulating components. Keep duration of exposure as short as possible.
- Expose the cleaned surface to the air for at least two hours.

11.4 Avoid condensation

To ensure the specified insulating level, the switchgear panels – especially their insulating components – must not be exposed to condensation.

Measures to take in case of condensation:
- Should condensation be detected in or on the panels, clean the panels in accordance with Chapter 11.3, page 60.
- Installation or inspection of panel heating. It must provide a sufficient heating performance to prevent condensation on the panels.
- Condensation can also be prevented by ensuring suitable ventilation and heating of the station or by using de-humidification devices.

11.5 Corrosion protection

Drive mechanisms and covers have a long-term protection against corrosion. Any damage to the paint, scratches and other damage must be repaired immediately to avoid corrosion.

11.6 Replacement of components and panels

The drive mechanisms, current transformers and voltage transformers as well as the testing and monitoring systems can be replaced if necessary. Also, entire panels can be replaced.

Should you have any queries regarding replacement of components or panels, please contact the manufacturer's Service Center.

The data on the nameplate are relevant for replacement of components or panels or in case of any queries (see also Chapter 2.5, page 12).

11.7 Lubrication instructions

Important:
- The bearings and joints must not be washed out by the cleaning agent.
- The following elements must not be lubricated:
  - Motor
  - Ball bearings
  - Auxiliary releases
  - Push switches
  - Blocking coils
  - Auxiliary switch
- Only approved lubricants may be used (see Chapter 12.1, page 62).

Preparation

- Remove the truck from the panel (see Chapter 4.5, page 19).
- Clean lubrication points using a lint-free cloth; use cleaning agent in case of serious contamination (see “Annex”, Chapter 12.1, page 63). Use cleaning agents sparingly; lubricating points must only be moistened.

Lubrication

Lubrication points (see also Fig. 71 on page 61)	Lubricants (see “Annex“, Chapter 12.1, page 62)	Lubrication procedure
Sliding contact surfaces	Synthetic lubricant	Apply a thin and uniform film of lubricant
All accessible friction points and sliding surfaces	Synthetic lubricant	Clean lubrication points with lint-free cotton cloth; apply a thin film of lubricant (using e.g. a paintbrush).
Bearings and joints	Liquid lubricant	Pour drops of liquid lubricant (oil can, drip feed lubricator) into the bearing gap. Liquid lubricant gets between the bearing surfaces due to the capillary effect. In case of inaccessible lubrication points, use an extension tube or spray.

11 Maintenance (contd.)

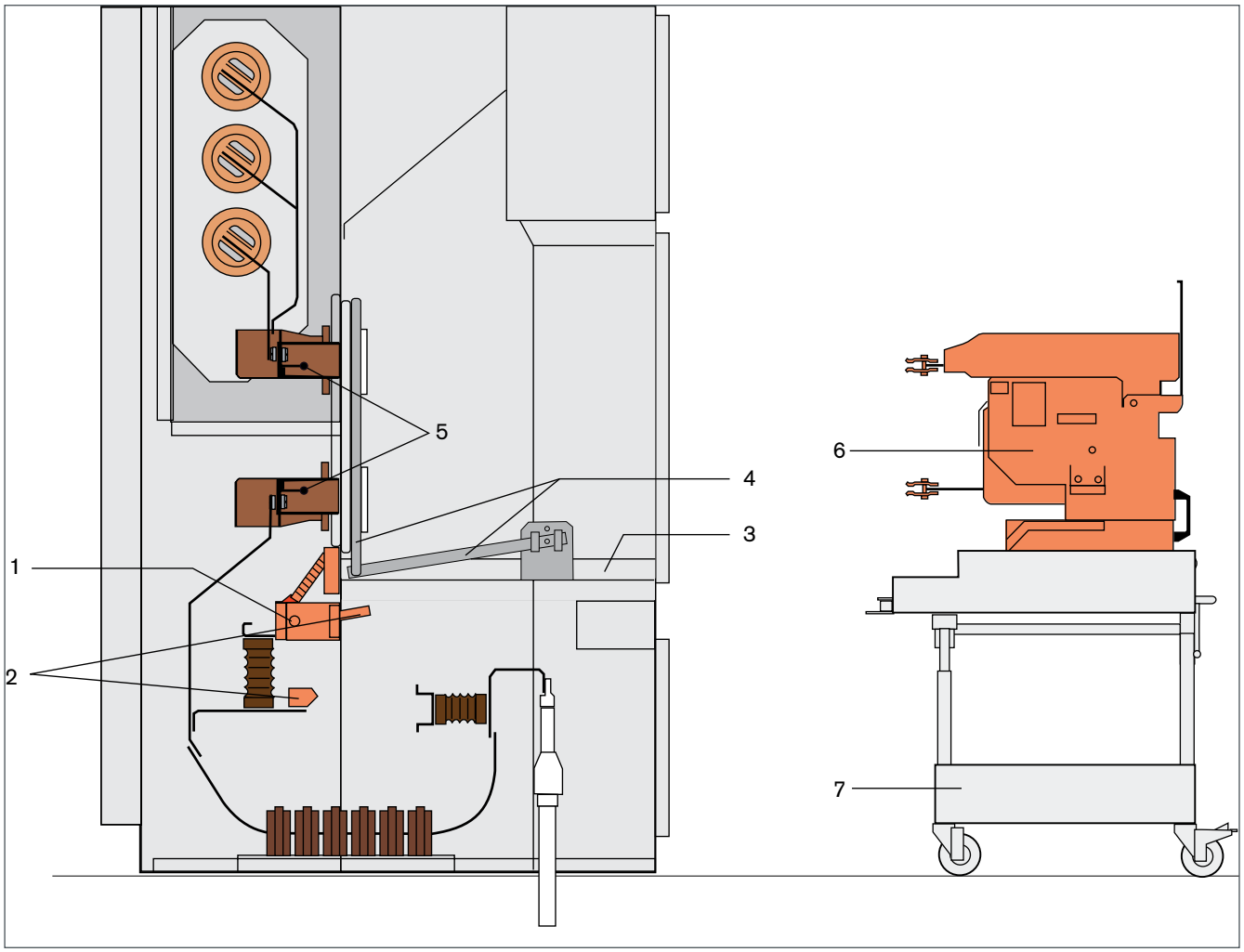


Fig. 71
Points of lubrication/maintenance
1 Earthing switch drive
2 Earthing switch contacts
3 Tracks for the truck
4 Shutter mechanism
5 Fixed contacts for the truck
6 Switching device (lubrication in acc. with lubrication instructions in the operating manual CVX)
7 Trolley, handling: see Chapter 12.5 on page 65).

Once maintenance work is complete

- Remove all the tools and auxiliary equipment used.
- Reinsert truck into the panel (see Chapter 4.5, page 19).
- Reposition covers, close doors and check switching functions (see Chapter 9 as of page 44).

12 Annex

12.1 Auxiliary products

The auxiliary products are available from the manufacturer. The use of alternative auxiliary products is not permissible.

Warning!
Risk of injury in case of inappropriate handling.
Observe the safety data sheets of the manufacturers of the auxiliary products.

Auxiliary products	Ref. no.
Cleaning agent	S 008 152
Synthetic lubricant, 0.5 kg can	ST 312-111-835
Liquid lubricant FL, 0.5 kg can	S 008153
Touch-up pen RAL 7044, silk-grey, 50 ml	S 009 561

12.2 How to treat the contact surfaces

Important:
- Caution when handling bars insulated by heat-shrinkable sleeves: The heat-shrinkable sleeve must not get into contact with lubricant (swelling).
- Contact areas coated with synthetic lubricant should not betouched, if possible.

■ Contact areas must be subjected to preliminary treatment before screwfastening (see Table below).
■ Immediately after the pre-treatment, coat the contact surfaces sparingly with a thin and uniform film of synthetic lubricant so that the space between the contact surfaces is completely filled once the screws have been fastened.

Material of contact surfaces	Pre-treatment
Silver-plated	Clean[1]
Nickel-plated	Remove passivation layer[4]
Copper or copper alloy	Clean[1], expose metallic surface[2]
Aluminium	Clean[1], expose metallic surface[2]
Steel	Clean[1], expose metallic surface[2]
Zinc-plated steel	Remove passivation, not, however, the zinc layer[3]
Hot-galvanized sheet-metal	Clean[1], passivation need not be removed

[1] Clean by means of lint-free cloth; use cleaning agent in case of serious contamination
[2] Expose metallic surface
□ by treating the entire surface with emery cloth or a rotating grinding tool (grain size 100 or 80) or
□ using a wire brush which is clearly marked for use exclusively for aluminium or exclusively for copper
[3] using a brass brush, steel brush
[4] rub slightly by hand using Scotchbrite abrasive agent (Ni layer must not be reduced)

12.3 Specifications for screw connections

Important:
- The threads of screws and bolts must generally not be pretreated
- Max. tolerance for the effective tightening torques: ±15 %
- The nut must correspond in strength to the grade of the screw/ bolt used or be of better quality.

General screw connections

	Grade or material		
Screw/bolt	Plastics	≥ 8.8 ≤ 10.9	Self-locking screw ≥ 8.8
Thread Ø	**Tightening torques (Nm)**		
M 4	0.25	2.6	
M 5	0.5	5.0	7.0
M 6	0.8	8.8	12.3
M 8	1.8	21.0	30.0
M 10	3.5	42.0	59.0
M 12	6.0	70.0	97
M 16	12	170	
M 20		330	

Screw fastening for power transmission

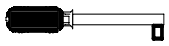
Screws and bolts: Grade ≥ 8.8

Conductor material: copper	
Thread Ø	**Tightening torques (Nm)**
M 6	6,5
M 8	17
M 10	35
M 12	68
M 16	135

Screw connection for terminal strips

Thread Ø	Tightening torques (Nm)
M 2.5 (M 2.6)	0.5
M 3	0.7
M 3.5	1.0
M 4	1.5
M 5	2.5

12.4 Required tools (not included in the scope of supplies)

Cutter	
Nail puller	
approved torque wrenches with different bits for hexagon socket screws and socket-head screws and nuts; bits for screw and nut grades M 5, M 6, M 8, M 10, M 12	
Screwdriver and Philips screwdriver	
Cutting pliers	
4 crane straps/chains of L ≥ 2000 mm each, capacity ≥ 1500 kg	
lint-free, clean rags	

12.5 Transport trolley for truck

Transport trolley for truck

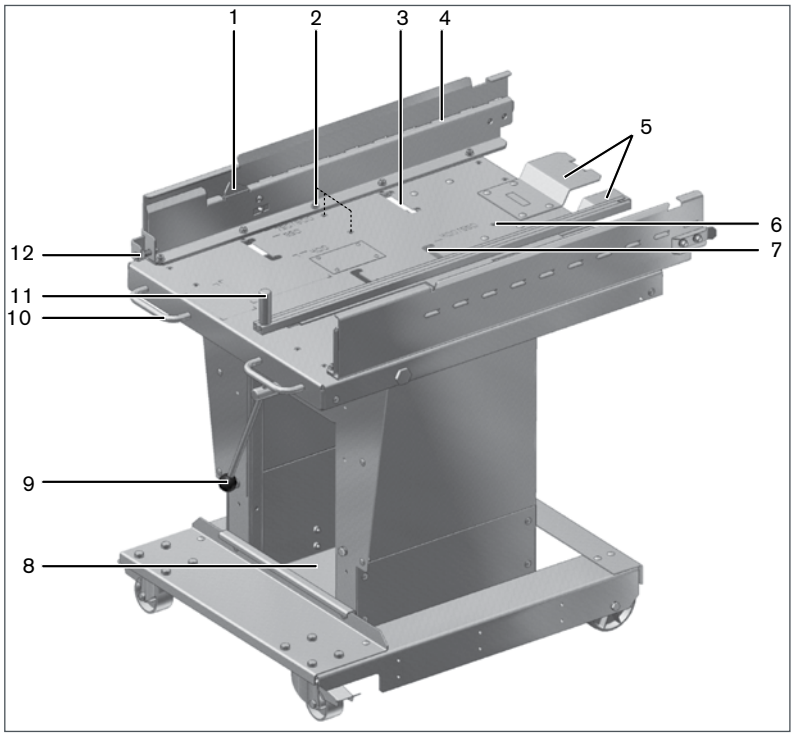


Fig. 72
Transport trolley for truck

1 Autonomous interlocking of the racked-in truck on the trolley
2 Variable screw connection of rail
3 Positioning of rail to adjust the various track widths
4 Rail
5 Interlocking with panel
6 Variable screw connection of unlocking bar
7 Positioning of unlocking bar to match various panel versions
8 Tray for accessories (lever, keys, handle)
9 Lever to lock / unlock the transport trolley on the panel. Table of trolley is lifted or lowered.
10 Unlocking bar. The truck is unlocked in the panel.
11 Handle of trolley
12 Slide to unlock the truck from the trolley

12 Annex (contd.)

Rated voltage Ur of the panel [kV]	Panel width [mm]	Truck	Item number of trolley
≤ 12	400/650/800	HVX/UTX/MTX/ CVX	EIB AE1 148-01[1]

[1] The trolley can be used for panel widths of 400, 650 and 800 mm

Adjusting the track width of the rails

- Release 3 screws on each rail (Fig. 72, item 2).
- Adjust the two rails to the appropriate panel track width and check them. Re-mount the six screws.
- Adapt position of unlocking bar (10) also to the appropriate panel (same procedure).

Notes

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